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CORPS COMMAND POST ARCHITECTURE FOR THE
1986-1990 INTEGRATED BATTLEFIELD--
A VULNERABILITY ANALYSIS

A thesis presented to the Faculty of the U.S. Army
✓ Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE

by

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Fort Leavenworth, Kansas
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The TAC CP, lacking communications and appropriate staff, is not a true alternate to the Main CP. An Alternate CP, a mirror image of the Main CP and dispersed into cells, is recommended for continuity of command and control.

Intelligence communications and nuclear release systems terminate at TAC CP, corps and division artillery for redundancy and timely targeting.

Spread spectrum techniques used by DARPA's packet radio system provide complex communications required by widely dispersed, redundant, and highly mobile cells. Variation of Josephson junction switches might reduce electromagnetic pulse effects.

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Corps Command Post Architecture for the 1986-1990 Integrated
Battlefield--A Vulnerability Analysis

John R. Bondanella, MAJ, USA
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Final report 6 June 1980

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MASTER OF MILITARY ART AND SCIENCE

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1986-1990 INTEGRATED BATTLEFIELD--A VULNERABILITY ANALYSIS

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

CORPS COMMAND POST ARCHITECTURE FOR THE 1986-1990
INTEGRATED BATTLEFIELD--A VULNERABILITY ANALYSIS, by Major
John R. Bondanella, USA, 172 pages.

This study estimates that the 1986-1990 European battlefield will be integrated (characterized by nuclear and conventional weapons). Current doctrine is reviewed, vulnerabilities to nuclear weapons are identified, and solutions to reduce vulnerabilities are proposed.

Investigation reveals primary causes of vulnerabilities are lack of dispersion and of true redundancy. Proposed solutions are to disperse Main CP into cells and separate them by two lethal radii of 100 kiloton weapon, using "Minimum Safety Distance" rather than "Latent Lethality" tables. Calculations consider cumulative rather than single dose of nuclear radiation. Recommended cell dispersion is 20 kilometers.

The TAC CP, lacking communications and appropriate staff, is not a true alternate to Main CP. An Alternate CP, a mirror image of the Main CP and dispersed into cells, is recommended for continuity of command and control.

Intelligence communications and nuclear release systems terminate at TAC CP, corps and division artillery for redundancy and timely targeting.

Spread spectrum techniques used by DARPA's packet radio system provide complex communications required by widely dispersed, redundant, and highly mobile cells. Variation of Josephson junction switches might reduce electromagnetic pulse effects.

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CHAPTER 1

THE PROBLEM AND ITS SETTING

Section I. STATEMENT OF THE PROBLEM

This research estimates that the 1986-1990 European battlefield will most likely be integrated (i.e., characterized by the use of nuclear weapons in addition to conventional weapons), identifies the vulnerabilities of current corps command posts on the integrated European battlefield, and identifies proposed solutions which can be used in reducing the vulnerability of corps command posts on the 1986-1990 integrated European battlefield.

Section II. THE SUBPROBLEMS

There are four subproblems which were researched.

1. The first subproblem was to determine whether the battlefield would most likely be characterized by the use of conventional weapons only or by the use of nuclear weapons in addition to conventional weapons. This was accomplished by reviewing literature written by Soviet, US, and NATO professional military and political authors.

2. The second subproblem was to determine to what degree command post architecture and doctrine are based on a consideration of nuclear effects. This was

accomplished by reviewing US Army doctrinal literature and selected organizational procedures concerning division and corps command post architecture, operations, and deployment. Command post concepts of the United Kingdom, France, West Germany, and the Soviet Union were reviewed to determine if there were any significant features, different than those of the US Army's command posts, which consider the effects of nuclear weapons.

3. The third subproblem was to identify the vulnerabilities of current US corps command posts on the integrated battlefield. Charts, tables, and analytic equations were used to calculate the effects of nuclear radiation, overpressure from blast, thermal radiation, and electromagnetic pulse on hypothetical command post deployment based on current US Army concepts. Selection of nuclear effects data was based on an estimate of the most likely nuclear weapons to be used by the threat forces.

4. The fourth subproblem was to identify proposed solutions which could be used in reducing the vulnerability of corps command posts on the 1986-1990 integrated European battlefield.

Section III. THE HYPOTHESES

1. The first hypothesis is that the 1986-1990 European battlefield will most likely be integrated (i.e., characterized by the use of nuclear weapons in addition to conventional weapons).

2. The second hypothesis is that current corps command posts are not designed to be survivable on the integrated battlefield.

3. The third hypothesis is that current corps command posts would not be survivable and effective on the integrated battlefield based on vulnerabilities to the effects of nuclear weapons.

4. The fourth hypothesis is that there are solutions which can be used in reducing the vulnerabilities and enhancing the effectiveness of corps command posts on the 1986-1990 integrated European battlefield.

Section IV. SCOPE

The effectiveness of any command, control, and communication system (C^3), whether military or civilian, is dependent on four major variables: personnel to operate the system; equipment to facilitate operations; procedures by which information will be operated on; and actual employment (deployment) of personnel, equipment, and procedures in a given situation.¹ The military command, control and communication system differs from a civilian system because the given situation involves deployment on a hostile battlefield and the system's ultimate effectiveness is measured by physical survival rather than economic "survival". The manner in which the military system is deployed can influence the probability of discovery by enemy target acquisition means. The "signature" of this deployed system provides information to

enemy intelligence elements, leading to identification, location, and then to some determination that this is a target worth attacking by some weapon system. The type of enemy weapon, the actual physical deployment of the C³ facilities, and the nature of the C³ equipment influence the outcome of the enemy attack. Combat developers cannot specify in advance, but can estimate, the type enemy weapon to be employed; however, they can specify how forces should be deployed and how equipment will be designed. By doing so judiciously, the combat developer can strive to reduce the enemy's probability of target acquisition and limit the effectiveness of the weapons which the enemy will most likely use.

Actual deployment is governed by battlefield conditions at the time of deployment and by the design of equipment which is available for deployment. Judgement of battlefield conditions is made at the time of actual deployment. However, equipment design is based on expected battlefield conditions (intelligence estimates of enemy unit deployment weapon systems) and on concepts of assumed friendly deployments.

This research does not address personnel manning the system nor detailed standing operating procedures. A military organization changes procedures based on the personality of the commander and the capabilities of staff members, factors which are in constant flux. More enduring are the enemy threat, the equipment which supports the unit, and the terrain on which the battles will be fought.

This research focuses on improving survivability by identifying criteria for command post architecture based on a set of developed battlefield conditions and on concepts of assumed deployments. It should lead the way to preferred deployment concepts and practices, and it should suggest design of a system to support these concepts in terms of organization, equipment capabilities, and a foundation for equipment procurement quantities.

Section V. LIMITATIONS

1. This research is based on historical studies, analytic studies, US Army current and proposed doctrine, and unclassified estimates of the threat to US Army forces in Europe. It is not based on empirical research designed by the author to test proposed doctrinal criteria. Where such data are available from other studies, they are included.

2. Command post structure is examined only as it pertains to battle in Europe to D+60 days.

3. Proposed command post doctrine is based on corps in the defense only, assuming that US forces in Europe act consistent with the overall alignment of NATO as a defensive rather than offensive organization. It is assumed that US offensive operations will be limited to not more than division size, and they will be controlled by a corps as it would be configured for defensive operations.

Section VI. ASSUMPTIONS

1. The corps will continue to be the focal point for initiating tactical nuclear requests based on military considerations. Use of tactical nuclear weapons based on political considerations will be initiated by political decision makers.

2. There will be no major technological breakthrough which results in deployment of enemy weapons with greater destructive power than current state-of-the-art nuclear weapons. This does not preclude the case where more efficient nuclear weapons may be deployed.

Section VII. IMPORTANCE OF THE STUDY

Command and Control Problems

US Secretary of Defense Brown has recognized that C³ overall improvements, including those of war headquarters, are required to insure the success of the NATO Long Term Defense Program. Secretary Brown's report to the Congress in 1979 states that C³ initiatives "...emphasize the achievement of survivability of essential command and control functions for US force management at lower levels of conflict... (and) in multinational operations in support of alliance commitments."²

The Organization of the Joint Chiefs of Staff cited six topics of special interest for 1980. Command, control, and communications systems are cited under both the topics

dealing with the NATO improvement programs and with general purpose forces. In both topical areas, the objective is to attain improved, secure, survivable, and where appropriate automated tactical C³ in the mid- and long-terms. This is necessary so that the theater C³ system can "...be responsive to requirements for intelligence collection, analysis, selection of military options, and force direction." A requirement also exists for these systems to be interoperable with similar systems of the NATO allies.³

Focus on the Corps

The corps command post in Europe is important for two reasons--

1. Its survivability may have a major influence on the control and employment of tactical nuclear weapons.
2. It is the focal point for integration of the air-land battle against Warsaw Pact army second-echelon divisions.

Integrated Battlefield

This research addresses operations on an integrated battlefield, i.e., one which will be characterized by the use of both conventional and nuclear weapons. The US Army Combined Arms Combat Developments Activity is currently conducting a study concerning survivability of command posts only in a conventional environment.⁴ The reported use of chemical weapons by the Soviet Union in the summer of 1979 and in January 1980 is an indication the Soviets will use the type of weapons it deems necessary to maintain its

superiority on the battlefield.⁵ The willingness of the Soviet Union to use non-conventional weapons is discussed in Chapter 3.

Planning, Programming, and Budgetting Impacts

Criteria for corps command post architecture may lead to new organizational structures with equipment, personnel, and functional requirements different than the requirements currently in the US defense program. These differences may be both qualitative and quantitative and will therefore have some impact on the programs contained in the current Army Program Objectives Memorandum (POM). The POM published in May 1980 will address forces, dollars, and manpower resources for the current fiscal year (1980), the budget fiscal year (1981), the program fiscal year (1982), and the four fiscal outyears (1983 to 1986).⁶ The Department of Defense Five Year Defense Plan addresses the dollar and manpower resources and the forces for the five year POM (Program year and four outyears) and the forces for three fiscal years beyond the POM (1987, 1988, 1989).⁷

The programs contained in the FY 80 defense budget concentrate on improving the effectiveness in combat of specific C³ hardware systems and somewhat their reduced vulnerability to electronic warfare, but they do not really address the vulnerability/survivability of the deployed command post in its entirety.⁸ Any changes to command post architecture

which affect Army programming and budgeting must be incorporated into the programming documents early enough to allow the actual change in deployed forces to occur in 1986.

ENDNOTES

1. V.V. Drushinin, D.S. Kontorov, Concept, Algorithm, Decision (Decision Making and Automation), Moscow, 1972, translated and published under the auspices of the United States Air Force, p. 80.
2. Secretary of Defense Harold Brown, Report of Secretary of Defense Harold Brown to the Congress on the FY 1980 Budget, FY 1981 Authorization Request and FY 1980-1984 Defense Programs, US Department of Defense, Washington, D.C., January 1979, pp. 235 and Appendix B2.
3. General David C. Jones and the Organization of the Joint Chiefs of Staff, US Military Posture for FY 1980 with Supplement Prepared by the Organization of the Joint Chiefs of Staff, US Department of Defense, Washington, D.C., 1979, pp. 38 and 43, and Appendix B1.
4. US Army Test and Evaluation Command, Study Plan, Command Post Countersurveillance Analysis, US Army Electronic Proving Ground, Fort Huachuca, Arizona, October 1979, p. 1-6.
5. "Soviets Rotating Forces in Afghanistan," Washington Post, Number 45, January 19, 1980, Washington, D.C., pp. A1 and A9.
6. The Department of the Army, Office of the Chief of Staff, US Army, January 1977, pp. 9-8 and 9-12.
7. US Army Command and General Staff College, Course P212, Lessons 11 and 12, MANAGEMENT, classroom issue material sheets P212-11&12, pp. L11&12-I-6.
8. Brown, op. cit., passim.

CHAPTER 2

BACKGROUND

Section I. THE US PERCEPTION OF THE BATTLEFIELD

Historical Perspective

The US Army designs its force consistent with the overall political strategy for the country. While the Army's plans and programs may reflect consistency with national strategy at the macro level, there may be a time lag at the micro level due to length of time to field necessary equipment. The US Army's perception of the tactical battlefield has changed several times in the past twenty-five years. This can be readily observed by looking at the organization and tactics of the division while considering the national strategy.

1. 1956-1961. President Eisenhower's nuclear strategy was one of "Massive Retaliation" based on the United States' strategic and tactical nuclear supremacy over the Soviet Union.¹ The US Army perceived the battlefield as primarily nuclear, and therefore implemented the Pentomic Division concept. This concept was developed to provide an organization which could effectively command and control tactical units under nuclear battle conditions of wide dispersion, rapid movement, decentralized operations, and defense in depth.²

2. 1962-1968. Presidents Kennedy and Johnson adhere to a policy of "Flexible Response" based on the possibility of the US having to fight on a variety of battlefields around the world, either nuclear or conventional. During these years, the Soviet Union also achieves strategic parity with the US.³ The US Army implemented the ROAD (Reorganization Objective Army Divisions) concept, based on a triangular division prepared to fight under either conventional or nuclear conditions. A division was structured so that it could be rapidly tailored for employment in a variety of situations.⁴ This concept was demonstrated by deploying divisions to Vietnam in different configurations.

3. 1969-1977. Presidents Nixon and Ford follow a "Strategy for Peace" which is based on sufficient quality and quantity of strategic nuclear weapons and on the willingness to use those weapons if needed; this strategy provides for "Realistic Deterrence" of nuclear war.⁵ The US Army continued to fight in Vietnam until 1973, paying little attention to the European battlefield. During 1976, the Army published Field Manual 100-5, Operations, which directed the Army to be prepared to fight an "Active Defense" oriented primarily on the conventional battlefield in Europe.⁶

4. 1977-1979. President Carter is dedicated to insuring the viability of NATO and strongly supports the NATO Triad--conventional, theater nuclear, and strategic nuclear forces--in a NATO Long-Term Defense Program.⁷ This policy shows commitment to NATO allied countries who "...consider

a credible threat of escalation as an indispensable element of the NATO deterrent." ⁸ The US Army continued to train and organize to fight on a conventional battlefield under the guidance of Field Manual 100-5.

Projected Trends

1. 1980-1986. The strategic policies of the US cannot be predicted with high confidence due to the turmoil in Iran and a Soviet presence in Afghanistan, which may lead to future involvement of the US in these and other areas in the Mideast which may affect the US national interest. The US Army programs are still being formulated for success on the conventional battlefield under the guidance of Field Manual 100-5. Material acquisition and tactical organizations are being developed to be fielded as part of "Division 86," a force which is designed primarily for conventional operations.⁹

2. 1987-1990. The strategic policies cannot be predicted with high confidence due to major near-term problems in the US-Soviet Union power relationship discussed above. The US Army may shift to a force designed to operate on the integrated battlefield, i.e., one characterized by both conventional and nuclear weapons. A change in the US Army's perception of the battlefield has been demonstrated recently by the US Army Chief of Staff. In April 1980, he stated that tactical doctrine concerning general operations should more fully explain the nature of operations on the integrated battlefield. ¹⁰ This will be discussed further in Section IV.

The eventual outcome of this direction is dependent on the degree to which this doctrine is used in formulating Army planning, programming, and budgeting policies.

Section II. GENERAL OPERATIONS ON THE INTEGRATED BATTLEFIELD

General

The US Army has oriented the majority of its training and development to the fight on the conventional battlefield in Europe. This is evident when reviewing both current and proposed doctrinal manuals concerning division and corps level operations, and is reinforced by statistics concerning the decline of professional articles dealing with tactical nuclear warfare (see Table 2-1). There are technical manuals and field manuals dealing with the effects of nuclear weapon employment, but they discuss primarily individual protective measures rather than unit tactical operations. Although the threat force is described as being nuclear-capable, a balanced appreciation of this threat is not portrayed. This is more fully discussed below.

Current Doctrinal Manuals

1. Field Manual 100-5, Operations is the manual which sets the tone for training and combat developments. There are a total of ten pages in the manual which address nuclear weapons or operations.¹¹ Four of these pages discuss approval for release procedures and planning for friendly nuclear weapons employment; three pages discuss nuclear weapons effects

PUBLICATION	YEARS	QUANTITY OF ARTICLES CONCERNING TACTICAL NUCLEAR WARFARE
Military Review	1950-59	164
	1960-69	46
	1970-78	13

Air University Periodical Index	1950-59	520
	1960-69	332
	1970-78	204

Source: John P. Rose, US ARMY NUCLEAR DOCTRINAL DEVELOPMENTS: THE NUCLEAR BATTLEFIELD, 1945-1977, unpublished Ph.D. dissertation, University of Southern California, Los Angeles, California, January 1978, p. 310, quoted in William D. Brown, "Whatever Happened To...Tactical Nuclear Warfare?" Military Review, Vol LX, No 1, January 1980, p. 47.

Table 2-1. Statistics concerning Professional Military Articles

in general; and two pages discuss trends in nuclear weapons. Only ^{one} page is devoted to "The Nuclear Battlefield". The manual contains forty-four pages concerning the conventional battlefield, discussing "How to Fight", "Offense", and "Defense".¹² The significance of this page count is put into perspective when reading the introduction to Field Manual 100-5 (Note: underlining is the author's):

This manual sets forth the basic concepts of US Army doctrine. These concepts form the foundation for what is taught in our service schools, and the guide for training and combat developments throughout the Army. FM 100-5, the capstone of the Army's system of field manuals, covers the relationships among operations.¹³

2. Field Manual 71-100, Armored and Mechanized Division Operations contains very sketchy information about the nuclear battlefield. It is oriented more on how nuclear weapons support operations rather than how units ought to operate under nuclear conditions.¹⁴ Chapter 3, "Preparation for Combat Operations", is nineteen pages long and contains only two short paragraphs concerning nuclear weapons. Those paragraphs are in the field artillery section and basically state that tentative nuclear targets should be developed by the division.¹⁵ The section on threat, Chapter 2, "The Enemy in Modern Battle," devotes twenty-two pages to discussing threat tactics, organizations, and weapons systems.¹⁶ That chapter has nine sentences that discuss enemy nuclear weapons, and one sentence that states the friendly commander should take certain measures to protect his troops:

If the enemy is likely to use nuclear, chemical, or biological weapons, it is necessary to prescribe a mission oriented protective posture (MOPP) for the division...For further discussion of MOPP, see FM 21-40, NBC Defense.¹⁷

Field Manual 21-40 will be discussed separately below, but it is important to note here that the reference to MOPP in Field Manual 71-100 is erroneous for operations in a nuclear environment. Field Manual 21-40 defines MOPP as a "...system of protection against chemical agents...in chemical warfare to facilitate mission accomplishment."¹⁸ (Note: underlining is this author's)

It is interesting to note that the threat chapter in Field Manual 71-100 discusses the difference in time of flight between the Soviet Sagger antitank missile (25 seconds) and that of the US TOW antitank missile (16 seconds).¹⁹ However, that manual does not mention the fact that the Soviet FROG rocket is nuclear capable, although it does show four FROG launchers in a FROG battalion of the threat tank division and an unspecified number (presumable four) in a FROG battalion of the threat motorized rifle division. The manual goes to great lengths to compare threat versus US weapons systems at the battalion/task force level, but does not compare nuclear capability at the division level.²⁰ This is a significant shortcoming, because a comparative division listing is possible at the unclassified level showing US nuclear artillery capability (155 mm howitzers and 8-inch guns) versus threat nuclear artillery capability (Soviet FROG rocket and almost no nuclear-capable field artillery.^{21, 22, 23, 24}

3. Training Circular 101-5. Control and Coordination of Division Operations mentions nuclear operations only from the standpoint of controlling friendly nuclear fires and from a historical perspective in the development of command posts in 1956 and 1960.²⁵

4. Field Manual 21-40, NBC Defense offers some practical guidelines to follow before, during and after a nuclear attack. It is heavily oriented toward operations in a chemical environment, which is evidently viewed as the most likely threat. It does provide better operational considerations than either Field Manual 100-5 or Field Manual 71-100. The manual never addresses the existence of electromagnetic pulse (EMP) and consequently provides no information concerning EMP effects on communications-electronics equipment, a vital factor on the nuclear battlefield.²⁶ Chapter 7, "Tactical Application of NBC Defense Procedures," discusses the impact of weather and terrain on nuclear weapons effects in general, troop safety when employing friendly nuclear weapons, and special considerations in the defense and retrograde. Chapter 9, "NBC Defense Considerations in Special Operations," discusses NBC effects in special situations such as airborne and air assault operations, mountain operations, military operations in built-up areas, and other special environments. This manual recognizes the possibility of operations on the nuclear battlefield. Although it is mainly directed at individual protection, it does highlight many areas to be considered when planning for unit

operations in a nuclear environment. Most of this information appeared in Field Manual 100-30 (Test), Tactical Nuclear Operations, which has been awaiting final publication since 1971. Apparently the US Army found that it was not necessary to publish a separate manual on nuclear operations, but rather to incorporate the majority of its contents into Field Manual 21-40.²⁷

Draft Doctrine

1. Field Manual 100-30 (Test), Tactical Nuclear Operations is a test manual (a published draft) which has been mostly incorporated into Field Manual 21-40. The manual, in existence since 1971, apparently will never be published as a separate document, but it does contain one significant aspect of tactical nuclear operations that was not incorporated into Field Manual 21-40. The manual is the only source which was found during this research that provides time estimates for the possible length of tactical nuclear operations. There is a most likely time of 30-60 days, and a probable maximum time of 120 days.²⁸ No explanation for these times is provided, such as depletion of the nuclear weapons stockpile (friendly or enemy), lack of personnel replacements, total destruction of all forces, escalation to strategic nuclear war, etc.

2. Field Manual 101-5 (Draft), Staff Organization and Operations is not a tactical manual in that it does not describe the manner in which units are employed on the battlefield, but rather it addresses the manner in which staffs

interact within their own organization. The manual is somewhat abstract from the battlefield, in that it is a "...guide for staff operations during both peace and war."²⁹ It does not take into account the intensity of war, but rather provides a schematic-type description of how entire staffs fit together. The personality of the commander and individual staff officers, together with the particular combat situation, affect the way in which staffs actually function. The important aspect that should be emphasized here is that this manual does not distinguish between peace and war nor between nuclear and conventional conflict, yet it claims to provide specific guidance for command post operations, movement planning, and battlefield information reporting in a tactical situation. The manual's treatment of command post operations will be discussed in Chapter 4 below.

The sections on "movement planning" and "battlefield information reporting" lack any indication that the integrated battlefield was considered in formulating doctrine.

Annex F, "Movement Planning," states that it "...describes the detailed planning and preparation necessary for a movement..."³⁰ The section on planning says that the "...planning necessary prior to the operation depends on..." the mission, the enemy, the terrain, and the time available. Although many subsets of data are listed under each of these factors, there is no mention of the planner examining the area through which movement will occur to determine if there is nuclear residual radiation present, if obstacles have been

created by a nuclear blast (cratering, tree blow-down, rubble in cities). Although the section on route reconnaissance specifies that there should be a determination of "...capacities of underpasses and bridges, location of culverts, ferries, and fords; and identifies critical points and obstacles," it fails to consider radiation contaminated areas as being vital.³¹ "Critical points" are discussed in the same paragraph as those points which involve congestion or require specific security measures. The section on assembly areas takes into consideration "range of enemy light artillery," "overhead concealment", "cover from direct fire", and "space for dispersion of vehicles, personnel, and equipment."³² The manual does not suggest checking for nuclear radiation. It does not state that requirements for protection from other effects of nuclear weapons may be different than cover from direct fire and overhead concealment from observation. To be fair, the requirement for dispersion may consider the effects of nuclear weapons, but it is doubtful that the reader of Field Manual 101-5 (Draft) would infer this.

Appendix H, "Commander's Battlefield Information Reporting System (CBIRS)" does not appear to consider the integrated battlefield. It states: "The CBIRS limits reported information to items which most clearly describe the combat status of a unit."³³ Although the CBIRS-prescribed reporting formats consider "...information on which the battle turns-- weapons, ammunition, people, and fuel...", there is no mention of Radiation Status of the unit.³⁴ Since Radiation

Status measures the cumulative dose received by a unit, it may be more influential in deciding a unit's combat status than the personnel shortage of the unit. CBIRS appears to be geared toward a number count of personnel, rather than the fitness of those personnel to fight. Line 4A, "Mission Status," of this report is a listing of the unit's tactical operation posture, i.e., attack, withdraw, etc. It does not address the degree of risk of further exposure to radiation.

The manual does address nuclear duties for the Chemical Officer, who supervises planning for various NBC defense measures. Among these duties is to supervise planning for radiation dose status and NBC reconnaissance.³⁵ What the manual does not say is that the US Army has no tactical device to measure initial radiation received, only the residual radiation being received at less than 500 rad. If the dosimeter needle reads off the scale beyond 500 rad, one must assume that one has an uncalibrated meter or that one has already received a fatal dose of radiation.

3. Field Manual 11-92 (Advance Copy), Combat Communications within the Corps does not mention or consider nuclear warfare. Although there are nine pages devoted to "electronic warfare", there is no mention anywhere of the effects of nuclear weapons on communications, especially from electromagnetic pulse and from degradation of radio wave propagation due to the nuclear fireball and radiation.³⁶

4. Field Manual 11-50, Combat Communications within the Division has an outstanding discussion featuring the effects of nuclear weapons on communications systems.³⁷ The manual discusses vulnerability of communication devices by type and by frequency to the effects of electromagnetic pulse and explains how to protect equipment from these effects by proper planning. It also discusses the nature and duration of blackout of radio wave propagation by type of burst, type of communications equipment, and frequency bands. This is the best treatment of the nature of the nuclear battlefield when compared to all the other manuals reviewed in this research.

Section III. INADEQUACY OF COMMAND POST DOCTRINE FOR INTEGRATED BATTLEFIELD

The current and draft doctrinal manuals reviewed in Section II above contain very little information concerning the integrated battlefield in general. The two manuals which provide detailed doctrinal guidance on division or corps command post operations are Field Manual 101-5 (Draft), Staff Organization and Operations and Training Circular 101-5, Control and Coordination of Division Operations. A proposed document, Training Circular 101-15, Control and Coordination of Corps Operations was circulated in draft form several times during 1976 and 1977, but has since been taken out of circulation by Headquarters, Training and Doctrine Command. The earlier drafts of Training Circular 101-15 appeared

similar in format and content to Training Circular 101-5. For that reason, it may be inferred that both manuals were based on the same principles, i.e., operations on the conventional battlefield in Europe.

Field Manual 101-5 discusses command post operations in general, but does not refer to operations on the integrated battlefield. Training Circular 101-5 views survivability of the command post in terms of being "...further to the rear, out of enemy artillery range..." and also discusses reduced vulnerability to electronic countermeasures.³⁸ These are valid issues on the conventional battlefield, but the manual does not discuss the issues on the integrated battlefield. One such issue affecting command post operations is the vulnerability of communications-electronics equipment to the electromagnetic pulse (EMP) effects of nuclear weapons. Field Manual 11-50 discusses protective measures against EMP effects. However, Field Manual 101-5(Draft) does not discuss EMP effects nor does it assign any staff responsibility for supervising protection against EMP effects. One might expect to find such supervision listed in the duties of the communications-electronic staff officer's area of responsibility, but it does not appear in Field Manual 101-5 (Draft).

Section IV. CURRENT ARMY ACTIONS TO IMPROVE COMMAND POSTS

General

The Army has conducted or contracted for many studies concerning command and control and command post structure.

Many of these studies concern implementing automated systems to solve problems with command and control. The more noteworthy studies are discussed below. There are some on-going studies which address organization, structure, and procedures, in addition to hardware systems, to solve the various survivability problems in command and control. These studies have tended to view the battlefield in terms of conventional warfare only, but there has been some recent effort toward examining command and control on the integrated battlefield.

Recent Studies

1. Army Battlefield Interface Concept 1979 (ABIC 79)

(U) is a document published by Headquarters, Department of the Army.⁴⁰ This document displays the requirement for interfaces among various automated systems at corps and below, and between those systems and the ones at echelons above corps. This is an excellent document to relate functional information exchange requirements, mostly automated, to hardware and software developments. ABIC 79 lists interfaces among those systems based on the requirements identified in existing material acquisition documents. The ABIC does not include requirements, although it does provide an extremely good framework within which some future requirements can be identified. It specifies the unit level to which a system is fielded, i.e., corps, division, etc. However, it does not always show how the system is deployed, i.e., at corps main command post, corps tactical command post, at least "x" kilometers from division main command post, etc. Since this document is

classified CONFIDENTIAL, it will not be discussed in detail in this thesis. There are portions which are UNCLASSIFIED, and these are addressed in this study where appropriate.

2. Army Command and Control Master Plan (AC²MP) (U) is a document which identifies problem areas in command and control and suggests some solutions for those problems.⁴¹ It proposes solutions in terms of system architectures for command post structure and functions during the near- and mid-terms. This document discusses alternative architectures, costs, and benefits of differing command post structures primarily in a conventional environment. Command post facilities are designed based on an analysis of conventional (non-nuclear) munitions effects against those facilities. The study did address some options for architecture based on a nuclear threat, but these options remained in draft form and were not incorporated in the final document.⁴² This draft document suggests that the Army examine different concepts of operation in addition to examining the traditional areas of mobility and hardening to improve survivability on the nuclear battlefield. This study is classified SECRET-NOFORN and will not be discussed in detail; unclassified portions are discussed.

3. Nuclear Survivability/Vulnerability Assessment for Army Tactical Command Posts/Units (U) examines factors which may impact on command post deployment at different levels of command.⁴³ This study examined current command post concepts and did not look at varying modes of operation; it focused on mobility and dispersion.

On-going Studies

1. Command Post Countersurveillance Analysis is a study being done by the US Army Combined Arms Combat Developments Activity (CACDA). It is an attempt to determine how vulnerable command posts are to threat surveillance and what must be done to decrease such vulnerability.⁴⁴ This study assumes that the battlefield will be conventional and therefore uses conventional weapons effectiveness in determining the damage to a command post resulting from enemy attack.⁴⁵

2. Corps 86 is a study being conducted by CACDA to determine the best corps headquarters structure for 1986. The focus is on developing corps tables of organization and equipment (TOE), considering missions, new automated command and control systems, new weapons systems and organizations in Division 86, and survivability of corps command posts.⁴⁶ This study is considering corps command post operations on the integrated battlefield.

3. Army Chief of Staff General Meyer stated in his April 1980 White Paper that doctrine concerning operations on the integrated battlefield must be "aggressively defined" and included in training continually.⁴⁷ He stated that there must be improvements in the communications systems between target acquisition systems, targeting cells at division, corps, and echelons above corps, and the nuclear delivery units. After the nuclear doctrine is defined, it "...must be accompanied by the necessary force structure, equipment, supplies, and training to provide credible deterrence."⁴⁸

Section V. CONCLUSIONS

Integrated Battlefield

A literature search revealed that doctrine concerning "How to Fight" and general operations on the integrated battlefield is absent from current doctrinal manuals. Although there have been references available concerning the integrated battlefield, these have been omitted from the current and draft manuals on general operations.

Command Posts of the Integrated Battlefield

There is a definite lack of doctrine concerning command post structure and deployment on the integrated battlefield. Until the Army Chief of Staff's White Paper in April 1980, most on-going studies have been focusing on command post survivability on the conventional battlefield.

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6. Field Manual 100-5, Operations (with Change 1), Department of the Army, Washington, D.C., September 1977, passim.

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29. Field Manual 101-5 (Draft), Staff Organization and Operations, Department of the Army, Washington, D.C., 1979, Preface. Document is undated, but was distributed in June.
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32. Ibid., pp. F-17 to F-18.
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36. Field Manual 11-92 (Advance Copy), Combat Communications within the Corps, Department of the Army, Washington, D.C., 1979, pp. 1-2 to 1-4, 2-1 to 2-6.
37. Field Manual 11-50, Combat Communications within the Division, Department of the Army, Washington, D.C., 31 March 1977, pp. 4-15 to 4-22.
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CHAPTER 3

THE NATURE OF THE 1986-1990 BATTLEFIELD

Section I. NUCLEAR VERSUS CONVENTIONAL BATTLEFIELD

General

The literature review in Chapter 2 revealed that the US doctrinal literature for general operations is not seriously based on the probability of nuclear weapons employment. The employment of nuclear weapons, by either the Warsaw Pact or NATO, is not a question of "If" but rather "When?". Soviet and NATO authors discuss the likelihood of employing nuclear weapons in Central Europe during a Warsaw Pact-NATO conflict. These authors generally explore the alternatives of employing nuclear weapons first at the initiation of war as opposed to some point after the war starts. They present rationale, based on theoretical wargaming of the various options, concerning whether the Soviets or NATO would be the first to use nuclear weapons. They try to determine which factors would force a country into using tactical nuclear weapons and which would serve as a deterrent to nuclear weapons employment. In any case, many authors conclude that a Warsaw Pact-NATO confrontation in Europe would most likely result in employment of tactical/theater nuclear weapons. This use would occur either at the start of war as a pre-

emptive measure or within a very short time after the war starts. The Soviets would most likely try to gain the initiative, while NATO would try to maintain a viable defense.

Soviet Intent

1. In the 1960's and 1970's, the Soviet Armed Forces underwent a series of fundamental changes in organization and equipment. A group of high ranking Soviet officers and generals authored a book which describes these changes as a "revolution in military affairs." That book was issued in the Soviet Officer's Library series.¹ The Soviet's reorganization was "...based upon equipping the services of the armed forces with the appropriate nuclear weapons..." needed to wage nuclear war.²

2. The US Army's doctrine, as portrayed in Chapter 2, changed from the basic concept of an all nuclear battlefield in 1956 to the concept of a conventional battlefield in 1976 (as shown in Field Manual 100-5). The Soviet doctrine has not swung quite so far. Manfred Woerner, Chairman of the Defense Committee in the Federal Republic of Germany Bundestag (Parliament), has reviewed a variety of analyses concerning the Soviet's greatly improved conventional capability and their large number of discussions and exercises of "conventional only" battles. He concluded that "...the equipment and training of Warsaw Pact forces, as well as prevailing Soviet military doctrine, continue to emphasize the concept of a fully integrated conventional and nuclear offensive."³ This view is shared by Colonel Graham Vernon,

US Army, who is currently a Senior Research Fellow in the National Defense University and the former Defense Army Attache in Moscow (1975-1977).⁴ An official US Army intelligence position in 1977 stated that Soviet doctrine does not question whether war will be nuclear or conventional, but rather states there may be a "temporary" conventional phase followed by a phase characterized by the integration of nuclear with conventional operations.⁵

Section II. IMPACT ON COMMAND POST DESIGN

General

The timing of first nuclear use has little impact on command post design criteria, and will not be discussed further. The high probability that the battlefield will be characterized by nuclear weapon use does have an impact on command post design criteria. Looking at the conventional battlefield only may lead to some shortfalls in the future. It is easier to go from an Army designed for operations on an integrated battlefield to conventional operations than it is to go in the reverse direction. There is no intent to sound the "doomsday trumpet" but rather to approach the battlefield as the Soviets have declared they will operate in any confrontation with NATO, i.e., using nuclear operations in the theater if appropriate.⁶

Conventional Threat

If the battlefield will most likely be conventional,

then the threat to corps command posts is basically from radioelectric combat, air strikes, conventional field and rocket artillery, and attack by ground troops. This conventional threat then leads to the assumption that a command post can be reconstituted in a short time. Attack by conventional weapons would not usually result in total destruction of the command post due to the physical limits on:

a. quantity of weapons that can be delivered during a given time.

b. the physical limits of the weapon's destructive power against the susceptible elements within the lethal bursting radius from the point of impact.

Integrated Threat

If the battlefield will most likely be characterized by the appearance of both conventional and nuclear weapons (the integrated battlefield), then the threat to corps command posts is basically from the effects of nuclear weapons. The nuclear threat leads to the assumption that a command post cannot be reconstituted in a short period of time. An attack by nuclear weapons could usually be expected to result in the complete destruction of an area target such as a command post currently configured. This is due to the wide limit of destructive power in the lethal area radius from the point of detonation.

Impact on Design

The assumption of conventional versus integrated battlefield may lead to different conclusions concerning the

design of a survivable corps command post for 1986 to 1990. The Command Post Countersurveillance Analysis being conducted for the US Army Combined Arms Center assumes that the battlefield will be conventional and therefore uses conventional weapons effectiveness in determining the damage to a command post resulting from enemy attack.⁷ Such a study will lead to certain design factors of command posts when considering such criteria as:

a. Acceptable thresholds of signature--will a conventional artillery battalion fire on a target based on data with target location error greater than 200 meters?

b. Degree of hardness--should a command post be protected from a direct hit or from fragmentation of artillery rounds or bombs?

c. Amount of dispersion--should the command post be dispersed enough to avoid unacceptable damage from the effects of a conventional airstrike of a certain length and width?

An analysis based on an integrated battlefield will lead to different design factors because different questions will be asked when considering such criteria as:

a. Acceptable threshold of signature--a target location error not much greater than one kilometer has little effect on targeting when considering that one SCUD missile with a nuclear warhead has a lethal radius against troops in the open of 10.5 kilometers.⁸

b. Degree of hardness--protection from blast, thermal and nuclear radiation, electromagnetic pulse effects.

c. Amount of dispersion--same factors as stated in "a" above.

A more detailed discussion of nuclear weapons effects on command post design will be discussed in Chapters 5 and 6.

Section III. ANTICIPATED ENEMY OPERATIONS

The Soviets plan for a battlefield which is characterized by employment of nuclear weapons by either side.⁹ They base their operational planning (army, front) on the assumption that tactical nuclear weapons will be employed during some stage of a major battle in Central Europe. At the strategic level, they believe that they must conduct blitzkrieg type operations by ground forces to secure NATO territory and secure an early victory.¹⁰ The manner in which this will be accomplished at the operational and tactical level is significantly different than it was during World War II under non-nuclear conditions.¹¹ During the past five years, US doctrinal literature, with Field Manual 100-5 as the model, centered on estimates that the Soviets would employ the traditional World War II breakthrough operations, with echelons massed in column as shown in Figure 3-1. In this same time, some authors have discussed a "new" Soviet tactic. This is referred to as the "daring thrust" or similar terms to indicate a series of small attacks across a broad front rather than massed at a decisive point as in the

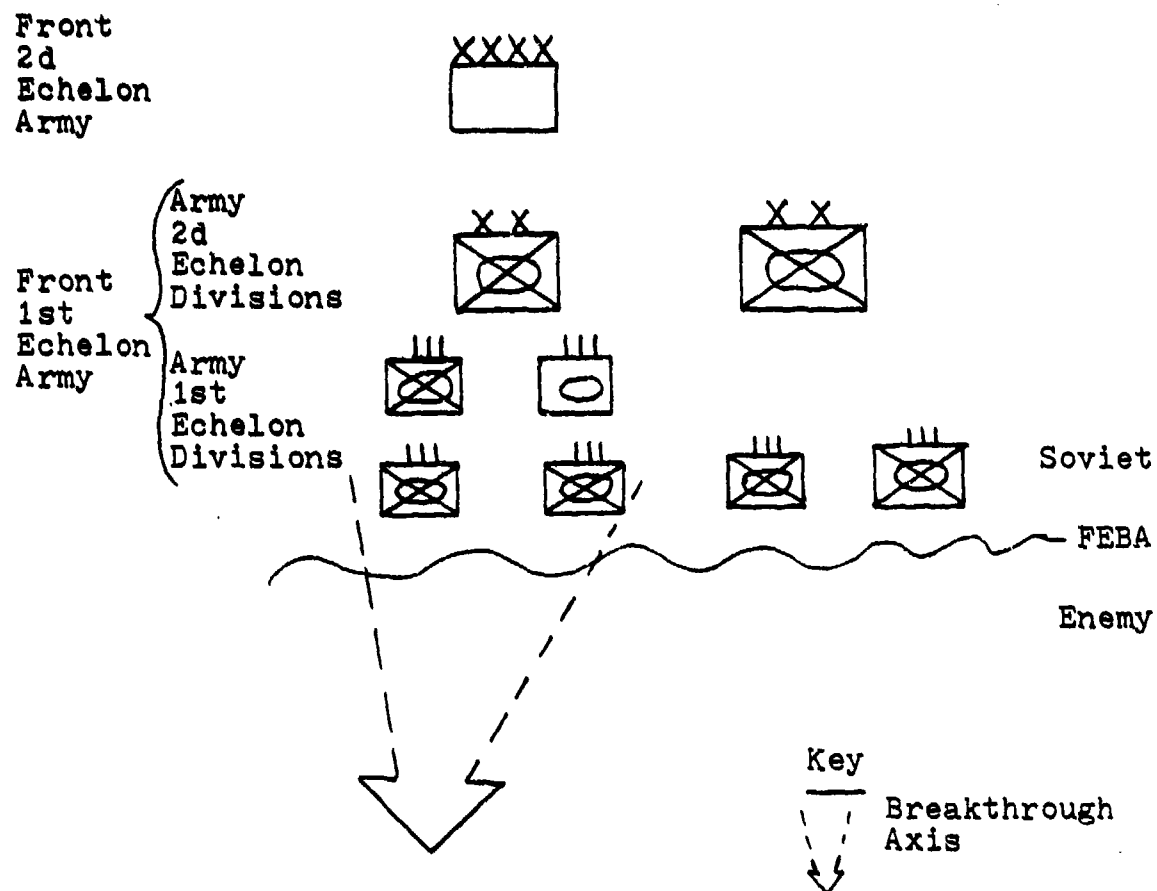


Figure 3-1. Classical Soviet Breakthrough Concept
(Modification of Figure 2C, Savkin, p. 204)

World War II model breakthrough.¹² This "new" tactic is not new, but has been published in concept for nuclear operations in 1958 and has been cited in Soviet writings.^{12, 13} US author Phillip Karber has reported that the statements of Soviet Minister of Defense Lieutenant General Reznichenko, Soviet Colonel Savelyev, and other Soviet authors changed the presumption that a breakthrough involving non-nuclear weapons must be conducted in World War II style.¹⁴ I think that these statements have been interpreted out of context, and that the Soviet authors have used the assumption that nuclear weapons will be used as a premise for their comments about "daring thrust" tactics. When Reznichenko speaks about these tactics, he states that the "...powerful means of suppression..." is the cause of the "...decisive character of modern combat actions."¹⁵ Colonel Lobachev, former commander of the Taman Guards Motor Rifle Division, wrote an article in which he stated that nuclear weapons were the best means of suppression of the enemy.¹⁶ Therefore, the citing of Reznichenko's article and others as implication that these "daring thrust" tactics apply only to the conventional battlefield appears to be erroneous.

The Soviet tactic of conducting small attacks across a broad front should be considered only in conjunction with nuclear weapon employment. It is this tactic that allows a force to mass in time rather than in space. Soviet Colonel V.Y. Savkin explains this and shows the tactic in a diagram in The Basic Principles of Operational Art and Tactics.¹⁷

A modified version of this diagram is shown in Figure 3-2 (Note: symbology was changed, not the thought content of diagram). The formation shown in Figure 3-2 portrays the massing of forces from the flanks and in the rear of the enemy. The intent is that the main attack is not so easily identified until after the nuclear strike occurs and the second echelon begins to converge on the main axis. This helps maintain the factor of surprise, which the Soviets feel strongly is necessary for success, especially on the integrated battlefield.¹⁸ While NATO forces are permanently or temporarily incapacitated due to the nuclear attack on or near the forward edge of the battle area (FEBA), the second echelon will maneuver to exploit the breakthrough at the point of penetration caused by the nuclear attack.

Prior to the nuclear attack, the Soviets will conduct intense reconnaissance and surveillance of the area to locate valuable nuclear targets, such as command and control centers, nuclear-capable delivery units, and reserve forces in an attempt to destroy them.¹⁹ Additionally, Soviet advance detachments in regimental strength will be operating up to 50 kilometers forward of their main body looking to disrupt command and control centers, nuclear delivery units, and reserves.²⁰

After the nuclear attack, exploiting forces can be expected to deploy through contaminated areas within hours. The Soviets have estimated that in a given area, after three hours only 23% of initial radiation levels exists; after six

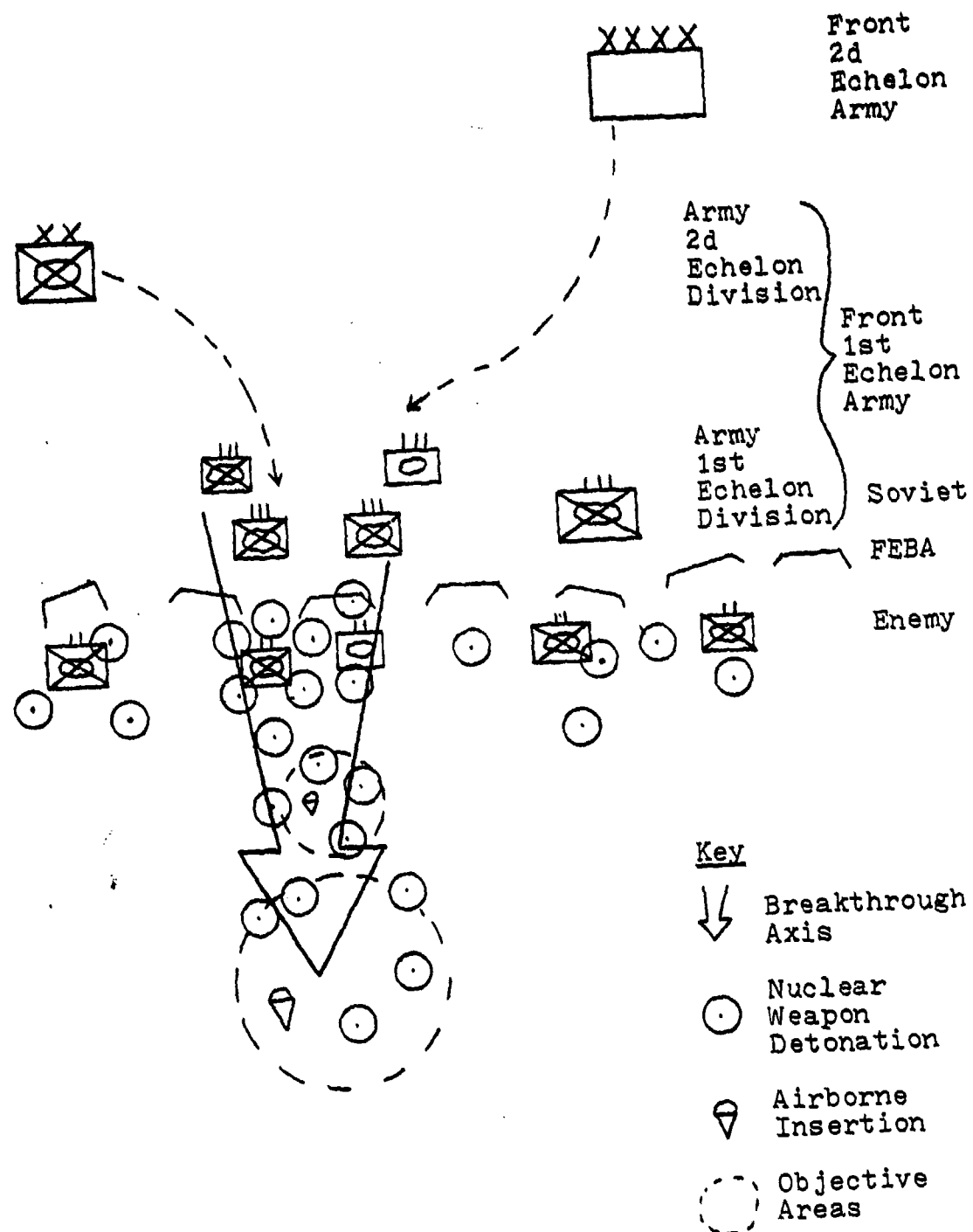


Figure 3-2. Soviet Nuclear Breakthrough Concept
(Modification of Figure 2D, Savkin, p. 204)

hours only 10% exists; and after ten hours only 6% exists.²¹ The Soviets train their personnel in the psychological and physical aspects of operating in such a contaminated environment. Troops are told that they will have to cross ground with a high radiation level and that they must be prepared even to fight on such ground, displaying the "highest form of heroism"--self-sacrifice.²² All units will have to "...carry out combat missions under conditions involving mass destruction, flooding of terrain, fires, and contamination of extensive areas..." due to nuclear weapon employment.²³

Section IV. SUMMARY OF ANALYSIS

1. The Soviets intend to fight an integrated battle in Central Europe, whether or not they are the ones who first use nuclear weapons on the battlefield.

2. The Soviets will use nuclear weapons to create a breakthrough situation, rather than the traditional World War II model, and will concentrate in time rather than in space.

3. Soviet troops are given training to build their confidence and commitment to fight on an integrated battlefield in spite of the dangers of radiation contamination.

Section V. CONCLUSIONS

A review of literature written by US, Soviet, and NATO professional military and political authors revealed the general intent of the Soviets to use tactical nuclear weapons on the European battlefield. The results of this review support the hypothesis that the 1986-1990 European battlefield most likely will be integrated, i.e., characterized by nuclear and conventional weapons.

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CHAPTER 4

PRESENT CORPS COMMAND POST DOCTRINE AND CONCEPTS

Section I. SUMMARY OF CORPS MISSIONS AND FUNCTIONS

The US Army corps is both an administrative and a tactical headquarters which has the capability to control up to five divisions and to provide the combat support and combat service support to those divisions.¹ There are 367 people authorized for assignment to the corps headquarters and headquarters company (HHC), but a total of about 700 people are normally deployed in and around the various corps headquarters locations in the field.² The US Army categorizes a corps force as either a forward deployed corps or a corps contingency force. The forward deployed corps is described as being already fully established in a theater of operations, nuclear capable, maintained in a high state of readiness, and normally part of an allied force structure. The corps operations within the assigned theater "...will be defensive in nature..." and the corps will have well-defined missions, areas of responsibility, and command relationships.³ A corps contingency force provides the ability for the Army "...to respond to a short-duration, limited objective, limited war conflict in which US forces are deployed to an area where there is no existing US base of operations (and)...operations are likely to be conducted in a nonactive

nuclear environment..."⁴ The two US Army corps in Europe (V and VII Corps) are categorized as forward deployed corps. It is this type of forward deployed corps which will be considered in this paper for operations on the integrated battlefield in Europe during 1986 to 1990.

The corps commander in Europe is responsible for many functions during combat, both in tactics and in administration. Those actions which have an almost immediate effect on the outcome of on-going combat are the employment of nuclear weapons, integration of the air-land battle, commitment of the corps reserve, and request for the commitment of the army reserve from the NATO Army Group to which the corps is assigned. The functions necessary to implement the above actions in a timely manner are similar to those battle management functions already identified as necessary for Division 86: intelligence collection and analysis, operational planning, control of deployed forces and available fire support. Those functions necessary to establish and maintain the capability to implement the above actions throughout the battle are force generation (analyze current operations; fight the follow-on echelon; interface with higher headquarters) and force generation support (resource monitoring; reconstitute systems and units; implement combat service support allocation priorities).⁵

The most critical and most sensitive corps functions on the battlefield will probably be those concerning the employment of nuclear weapons. Although many elements in a

theater are involved in nuclear fire planning, the corps commander is "...the focal point for planning the battlefield use of nuclear weapons and originating requests for authority to employ nuclear weapons."⁶ The other functions in the corps contribute information to the decision process concerning the employment of nuclear weapons. Intelligence collection and all-source analysis strive to give warning of when and where enemy nuclear attacks will most probably occur and where the best targets are for nuclear attack by friendly units. Logistics priorities and allocations are reviewed to support friendly nuclear offensive operations or to speed recovery from effects of enemy nuclear operations. Artillery fire support and air support planners re-allocate targets and ammunition supply rates, and monitor status and location of friendly nuclear firing units. Operations planners provide continuous strength and status information concerning friendly units in contact and corps reserves. If the enemy has already used nuclear weapons, the electromagnetic pulse effects may have caused temporary failure or permanent damage to communications equipment critical to the control of friendly nuclear weapons; the communications-electronics staff officer will have to ensure procedures and personnel are available for rapidly repairing or replacing damaged equipment.⁷

Section II. US COMMAND POST DOCTRINE AND CONCEPTS

General

The current US command post doctrine and concepts provide the starting point for determining whether changes are necessary for a forward deployed corps in Europe during 1986 to 1990. This section describes the various type deployments (Tactical, Main, and Rear Command Posts), physical facilities for these command posts, degree of redundancy, and deployment on terrain. In many cases, there is no current doctrine which provides exact details. Many details are left to the discretion of the local commander to be published either in operations plans (OPLANS) or in standing operating procedures (SOP).⁸ Doctrine is cited where it exists. Much current doctrine concerning corps command posts and corps operations in general is in draft form, and has been for at least the past six years.⁹ In the combat developments process, doctrine (operational concept) is supposed to be the formal basis for equipment and organizational development.¹⁰ In the absence of such doctrine, practice or current concepts will be described.

Type Deployments

The basic US Army corps command post (CP) deployments are referred to as the Main CP, the Tactical CP (TAC CP), and the Rear CP.¹¹ The two US Army corps (V and VII Corps) in Europe are currently using this three command post system.¹² The Main CP contains the majority of the functional elements of the staff required to analyze and control the

battle through management of combat and combat support forces. The TAC CP is a smaller element than the Main CP and is "...established to provide the commander a command and control facility and staff assistance at a location closer to his subordinate units."¹³ The Rear CP is responsible for coordination of combat service support operations. These organizations are discussed in more detail below. The communications system to support them is described in Section IV.

1. Main CP.

a. Composition. The Main CP consists of approximately 350-500 personnel and approximately 100 vehicles.¹⁴ These corps headquarters staff sections normally have the majority of their personnel at the Main CP: Command Group, G2, G3, G4, G5, Staff Engineer, Staff Weather Officer, Air Force Air Support Operations Company (ASOC), Nuclear Weapons Liaison Element, Operations element of G1, Adjutant General support element, Communications-Electronics Officer, Artillery Officer, Special Security Officer, Liaison Officers to Corps, Corps Headquarters and Headquarters Company.¹⁵ The heart of the Main CP is the corps tactical operations center (CTOC) consisting primarily of the Command Group, G2, G3, Artillery Fire Support Element, and the ASOC. The remainder of the Main CP is centered on the CTOC (see Figure 4-1). The personnel required to operate the Main CP (350-500) is in excess of the corps HHC table of organization and equipment (TOE), which authorizes only 367 personnel. These additional personnel

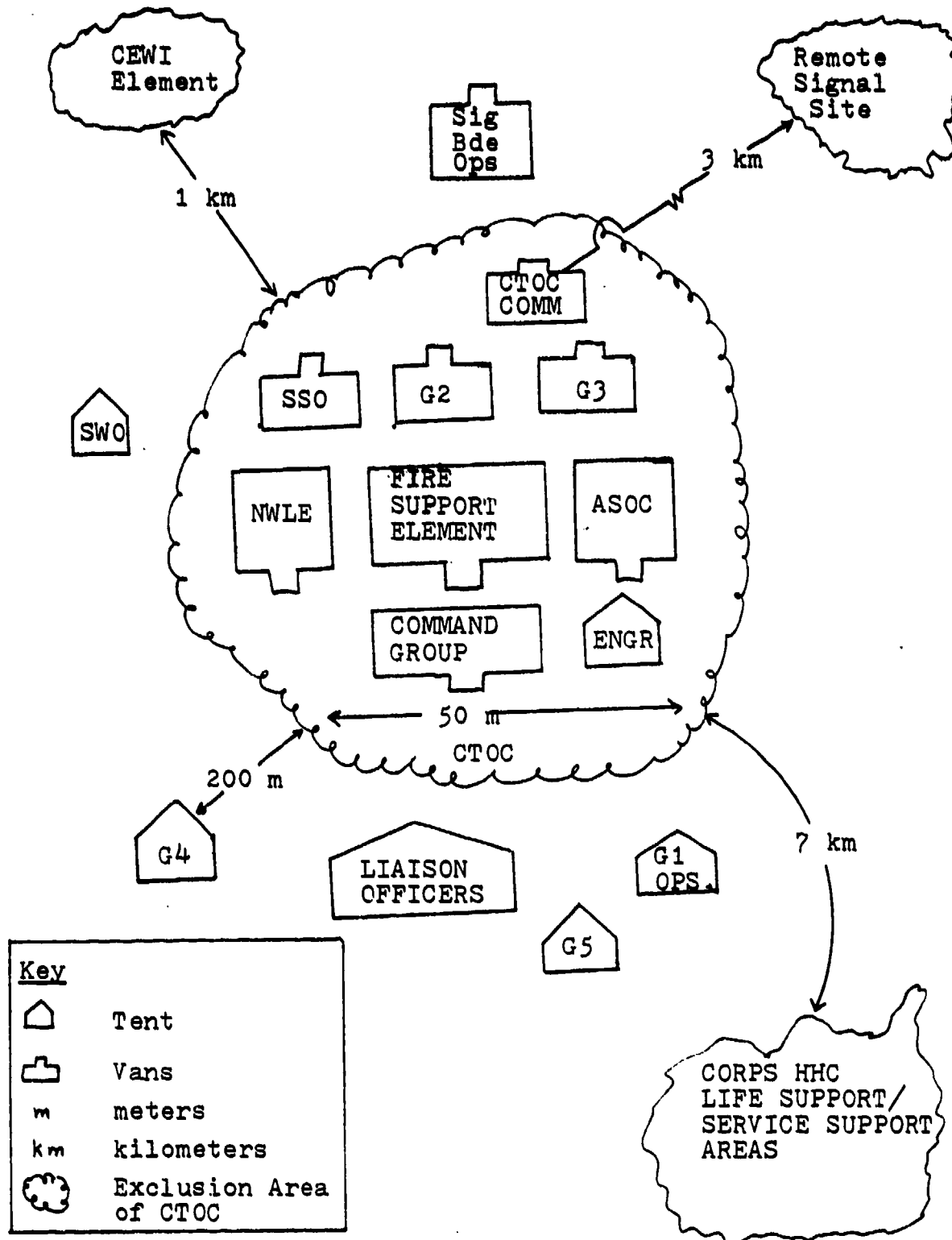


Figure 4-1. Type Corps Main Command Post

come from other units attached or subordinated to the corps headquarters in some form or another. The two largest sources of personnel are the corps signal brigade and the combat electronic-warfare intelligence (CEWI) group. For example, the proposed CEWI group has approximately 100 personnel under the direct supervision of the corps G2.¹⁶ Even though there is no CEWI group actually in existence by approved TOE at present, the majority of these personnel are currently working in the corps headquarters area and come from the corps military intelligence detachment and the corps Army Security Agency battalion.

b. Physical facilities. The location of the Main CP is a function of SOP or OPLAN. The Main CP cannot be continuously moved and still operate efficiently, so "...these command posts and their associated communications systems must be hardened to withstand attack from enemy air or artillery."¹⁷ Doctrine suggests that command posts can be hardened by locating them in buildings, basements, caves, tunnels, and in heavy bunkers, and that survivability of supporting communications equipment can be enhanced by using remote radios connected to the CP by underground cables and wires.¹⁸ The current TOE for a corps HHC provides equipment for operations from expansible vans on 5-ton truck chassis, from tents, and from collective protective shelters; most of this equipment can be placed inside a building for operations.¹⁹

c. Location on terrain. The selection of the Main CP location is based on SOP or OPLAN, with actual location

designated by the commander or his representative. Considerations include "...access to routes to forward and rear elements, good communications with senior and subordinate units, together with cover, dispersion, and concealment for various CP elements."²⁰

2. Tactical CP.

a. Composition. The TAC CP consists of approximately 60 personnel and 15-25 vehicles.²¹ The personnel quantity includes only those personnel operating full time at the TAC CP; the commander may augment those personnel with additional personnel from Main CP if the situation warrants. A type TAC CP may be staffed as shown in Table 4-1. These personnel quantities reflect almost an equal number of operating personnel (corps headquarters staff) and communications personnel from the supporting signal brigade.²²

b. Physical facilities. There is no doctrine which specifically states how a corps TAC CP is configured and deployed in a particular site. Field Manual 101-5 (Draft) states that a TAC CP (it implies corps or division) "...must be limited in physical size and electronic signature to help conceal the CP and to insure it can displace rapidly when necessary."²³ The same manual later states that the TAC CP "...size and electronic signature (should be)...no larger than a brigade CP."²⁴ The corps TOE provides three tracked command post vehicles (M577), ostensibly for this purpose.²⁵ The actual facilities used would be selected by the commander or published in SOP or OPLAN. In Europe, the TAC CP has

FUNCTION	QUANTITY OF PERSONNEL
<hr/>	
Corps TAC CP Staff Element ¹	
Deputy Commander	2
G2	6
G3	6
Fire Support Element	2
AG	2
MP	6
Maintenance	2
Mess	4
Medic	2
HQ Commandant	2
Sub-total	<u>34</u>
Communications Support ²	
Platoon Command	2
Radioteletype	4
Multichannel Radio	3
Radio-wire Integration	3
Telephone	6
Telecommunications Center	10
Sub-total	<u>28</u>
Total	<u>62</u>

Note: Personnel Figures do not include augmentees from
Corps Main CP when TAC CP has control of the battle.

1. Source: Personal experience of author.
2. Source: Field Manual 11-92, passim.

Table 4-1. TAC CP Personnel

not been limited to the M577, but has been deployed in other physical facilities, including buildings, expansible vans, and helicopters.²⁶

c. Location on terrain. Field Manual 101-5 (Draft) states that characteristics of the TAC CP site would include good communications between Main and subordinate (division) command posts and that it should be located near routes to these headquarters.²⁷

3. Rear CP.

a. Composition. The Rear CP consists of approximately 75 personnel.²⁸

b. Physical facilities and location on terrain. Field Manual 101-5 (Draft) states that the Rear CP is normally located close to the CP of the corps support command, since both elements work in very close coordination. The actual selection of a site is based on access to lines of communications, availability of facilities for maintenance and logistical operations, and good conditions for communications from the Rear CP to corps Main CP and to Corps Support Command CP.²⁹

Movement Procedures

There is some stress on displacing command posts frequently to increase survivability.³⁰ However, there is no doctrine which describes how each command post displaces, other than to state that it may be by bounds, by leap-frogging or by moving an entire CP at once.³¹ These procedures are

usually based on the commander's preferences and on an individual unit's SOP.

Command

The corps is currently designed for command to be executed from the Main CP. Each commander has his own style for how he actually executes command. The mobile tactical CP is intended to be used "...either as a forward tactical command post, a jump command post, or an alternate command post when required."³² In practice, the TAC CP concept at corps level is different than the TAC CP concept at division level. In the division, command of current operations is intended to be executed primarily from the division TAC CP.³³ At the corps level, the TAC CP takes control of the battle for short periods of time when the Main CP is not operational due to movement or damage,³⁴ or when the corps commander wants to maintain closer control of a certain aspect of the battle in a particular area.³⁵ The TAC CP is normally designed to maintain command and control of a corps for 18-36 hours.³⁶ For example, during several field exercises conducted by VII Corps in 1977-1978, the Main CP was ordered to move. A small TAC CP augmentation staff was sent from the Main CP to the TAC CP. Command was then passed to the TAC CP while the Main CP deployed to its new location. When the Main CP was established at its new location, command was passed from the TAC CP to the Main CP, and the TAC CP augmentation staff then returned to the Main CP.

Section III. FOREIGN ARMY COMMAND POST CONCEPTS

General

The current US doctrine for corps command posts was described in Section II. In order to gain additional perspective in formulating criteria for a European deployed US corps, the command post concepts of some other European countries were reviewed. This is not an attempt to examine the other countries' concepts in minute detail, but rather to see if there are any substantial differences in concepts which can be used advantageously in formulating US concepts. The command post concepts of the United Kingdom, France, West Germany, and the Soviet Union were reviewed and are summarized in this section.

United Kingdom

The British Army corps uses the terms Main and Rear Headquarters (HQ) for its command post concept.³⁷ The functional staffs located at each of these headquarters are very similar to the US concept. When the Main HQ displaces, a "Step-up HQ" is used to provide continuity of command. The Step-up HQ is a communications and skeletal staff element of the Main HQ which moves in advance to the new Main HQ location and establishes communications. It is then augmented by a small activation party from the Main HQ and receives command of the corps. Once command is passed to the Step-up HQ, the augmented Step-up HQ becomes the new Main HQ and most of the remaining elements at the former Main HQ deploy to this new

Main HQ. The other remaining elements at the former Main HQ are designated as the new Step-up HQ and they move to another location to facilitate future displacement of the Main HQ when necessary. There are other variations of this movement, such as leap-frogging of Main and Step-up HQ.³⁸ The corps commander may also form a small command group to operate independently for short periods; such a group would have adequate communications, primarily radio, with the divisions and the corps Main HQ.³⁹

France

The French army corps uses a system of two principal corps command posts: a Forward CP and a Rear CP.⁴⁰ The French Forward CP is organized similar to the US Main CP and its functions are the same. When the Forward CP must move, it sends a small staff and communications element to its new location. This element, similar to the British Step-up HQ, establishes interim communications while the Forward CP displaces to its new location. The French Rear CP is similar in organization and function to the US Rear CP. The French Corps establishes two special command posts as required.

These are:

1. The covering force CP. This is similar in function to the US Army Armored Cavalry Regiment (ACR) CP. It is established temporarily when there is a covering force mission to be conducted. Unlike the ACR, it has no regularly assigned forces, such as subordinate squadrons. It consists of corps headquarters staff personnel and communications

assets to control whatever forces have been assigned the covering force mission.

2. The Tactical CP. This CP is created temporarily to allow the commander to more closely control certain phases of the battle for a limited period of time. It is similar in function to the US TAC CP, but does not use the Tactical CP as a jump CP. It is most similar to the small command group formed by the British corps in terms of function.

West Germany

The West German Army corps uses two command posts-- a Main and a Rear CP. They do not establish a corps tactical CP. The corps headquarters consists of about 880 people.⁴¹ The Main CP usually occupies buildings and displaces infrequently. Communication is primarily by commercial telephone lines, dedicated to military support, which are connected to remote radios; such radios may be up to 100 kilometers away from the command post. The Main and Rear CP are each organized into functional cells, which are dispersed for survivability and are also connected by wire communications. The West German Army corps does not establish an alternate CP as a separate facility, but uses the CP of a designated subordinate headquarters when an alternate CP is required.⁴²

Soviet Union

The Soviet ground forces require that each army (Soviet equivalent of a US corps) deploy a Main CP and an

Alternate CP "...at a nuclear safe distance from each other...and in continuous operation."⁴³ The Alternate CP is required by doctrine to be fully manned, but is sometimes found at a reduced manning level. During lengthy moves, the Main and Alternate CP would leap-frog along different routes while maintaining continuous contact with subordinates, adjacent units, and higher headquarters. To enhance security, the supporting radio stations and special vehicles of a command post are dispersed at some distance at the halt.⁴⁴ Additionally, a Forward Command Post might deploy when necessary to control operations by being closer to the battle or when the Main CP is out of action or moving.⁴⁵ The Soviets establish a Rear Services Control Point to control the combat service support of the army.

Section IV. COMMUNICATIONS

General

This section addresses the doctrinal communications which support the corps headquarters. Due to the nature of command relationships in Europe with NATO, these other systems are also discussed. The US Army is currently writing doctrine for echelons above corps. Existing communications between army group (NATO Central Army Group (CENTAG) in the case of V and VII US Corps) and the corps is mainly a function of OPLAN, SOP, and other command directives.

Corps Signal Brigade

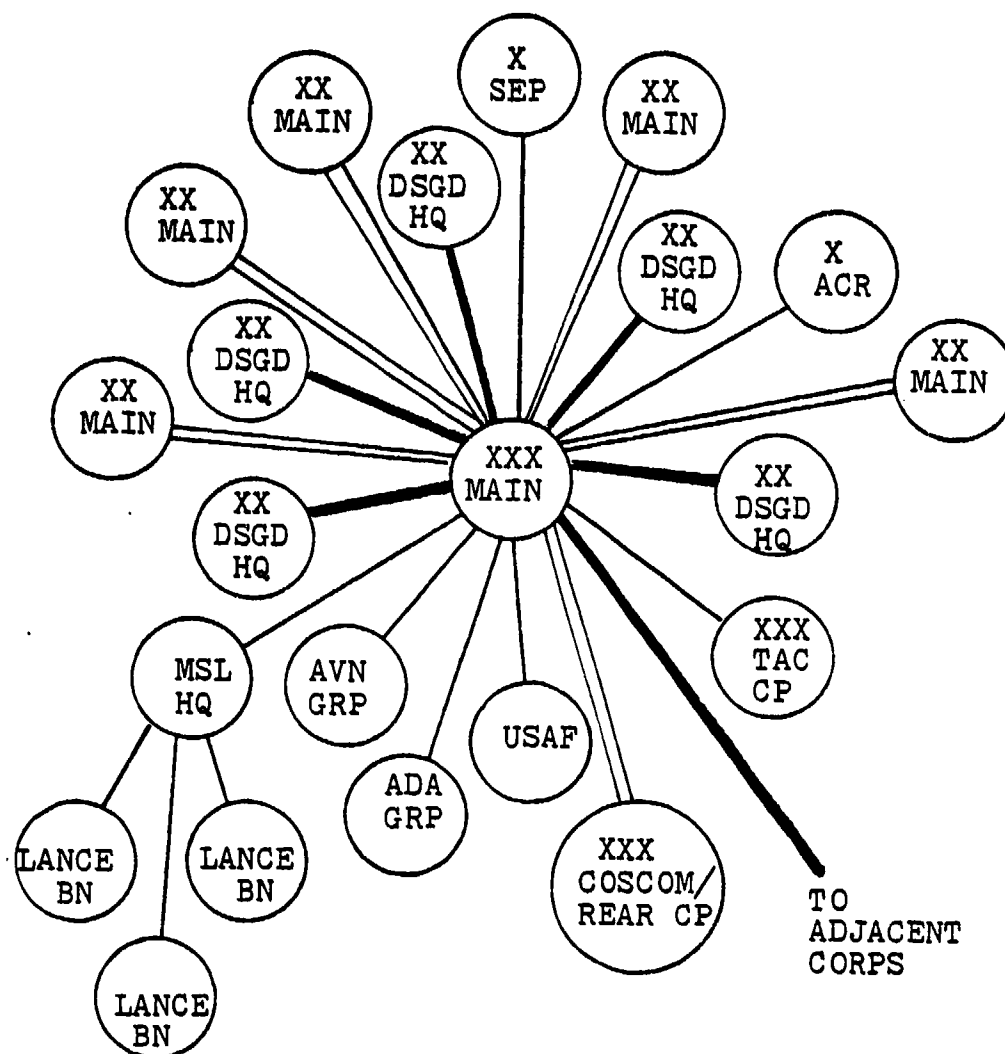
Communications between the corps headquarters and selected subordinate or adjacent headquarters is the function of the corps signal brigade. The type and capabilities of the communications provided to the corps headquarters will be discussed, rather than the organization of the corps signal brigade.

Type Communications Within the Corps




The corps currently has available a variety of communications. These are voice telephone and radio, radioteletype, multichannel radio and cable, and air and ground messengers. The multichannel network is the "backbone" of the corps communications system, with radioteletype as the primary backup.⁴⁶ The multichannel system operated by the signal brigade has specific nodes at the corps Main CP and TAC CP, and has a network of sixteen nodes located throughout the corps area to provide various users access to the corps command system. The systems serving the corps are shown graphically at Figures 4-2 through 4-6.

Type Communications from Echelons Above Corps

The two US corps in Europe are under NATO command during wartime. There is no doctrinal publication which specifies what communications exist between the corps, their NATO headquarters (currently CENTAG), and the US theater army headquarters to which the corps are assigned (US Army Europe and Seventh Army (USAREUR)). In practice, both

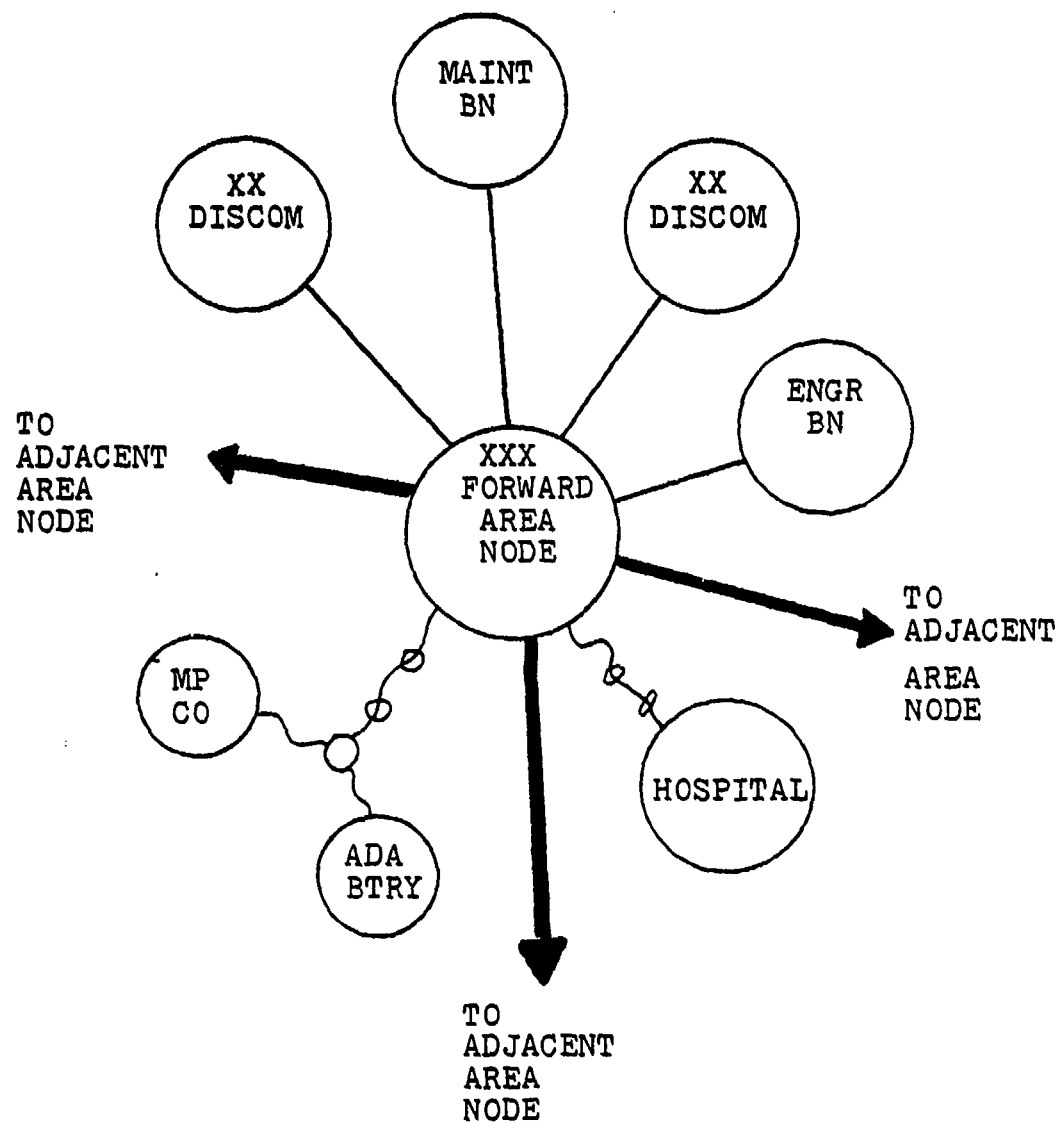


Key

-  24-Channel Troposcatter Radio
-  24-Channel Line-of-Sight Radio
-  12-Channel Line-of-Sight Radio
- DSGD HQ Division Commander Designates Location of where He Wants This Link to Terminate

Source: Field Manual 11-92, p. 5-3.

Figure 4-2. Corps Command Multichannel Radio System

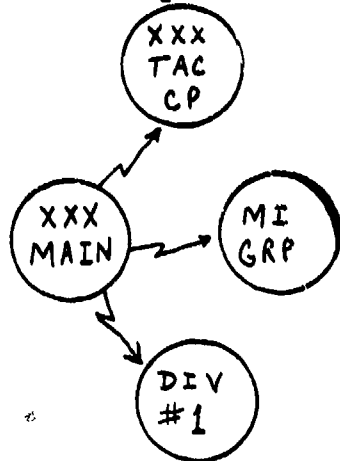
**Key**

- Radio
- o-o- Cable (Pulse Code Modulation)
- ➔ 48-Channel Radio

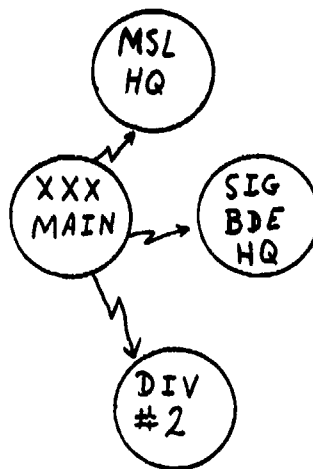
Source: Field Manual 11-92, p. 5-4.

Figure 4-3. Corps Forward Area Communications Node

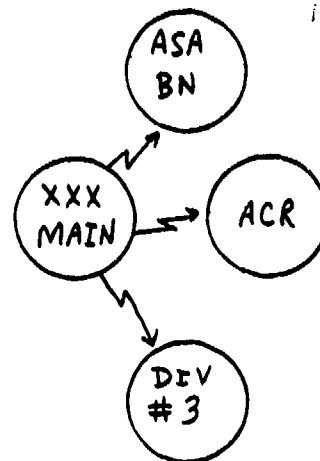
Command Ops Net #1



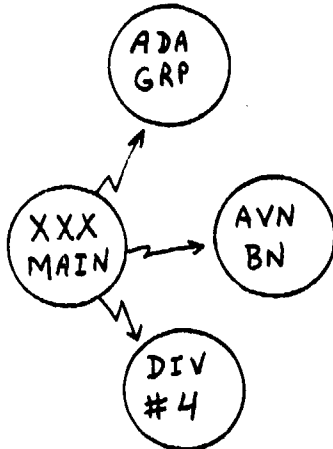
Command Ops Net #2



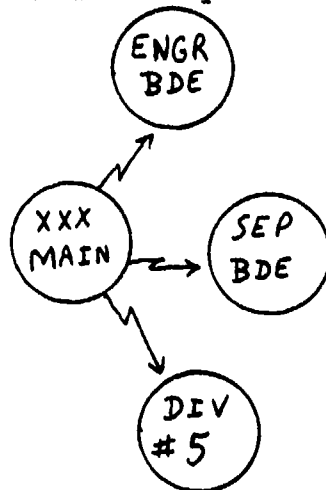
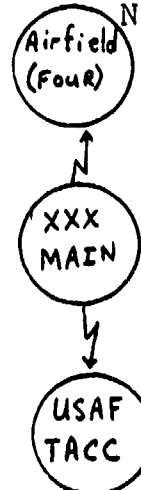
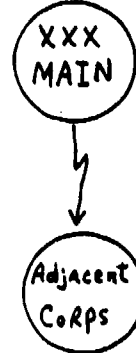
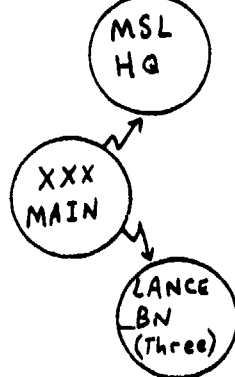
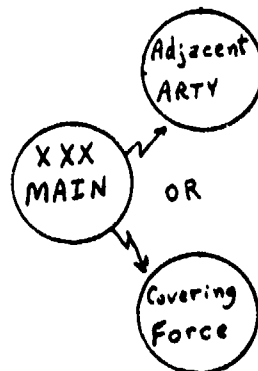
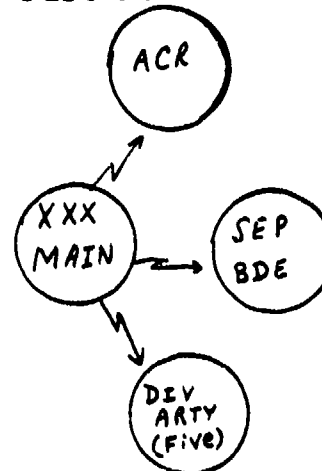
Command Ops Net #3



Command Ops Net #4

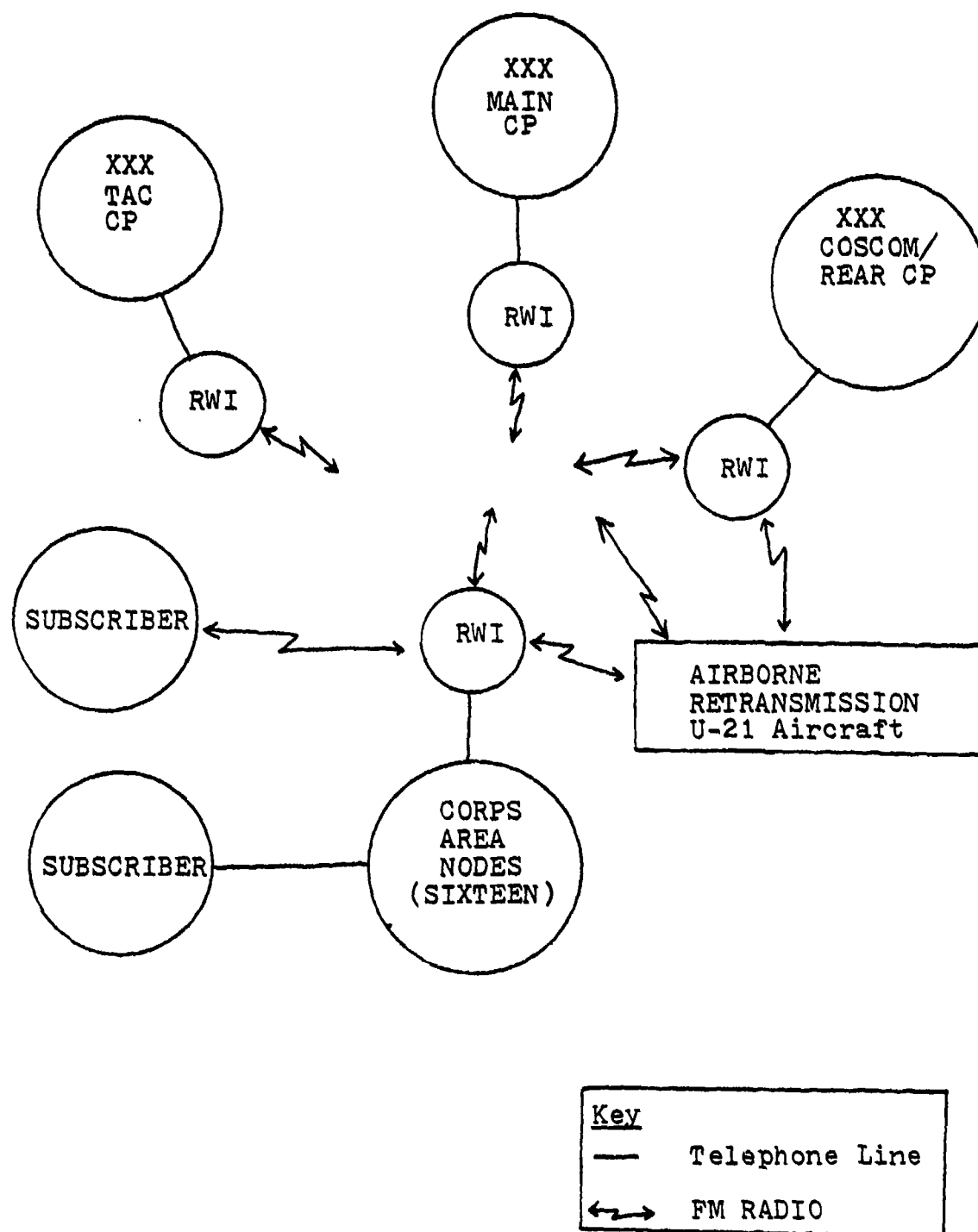


Command Ops Net #5

Ground
Liaison
Officer
NetAdjacent
Corps
NetCorps Arty
Command Fire NetArty Liaison or
Covering Force NetCorps Arty
Fire Net

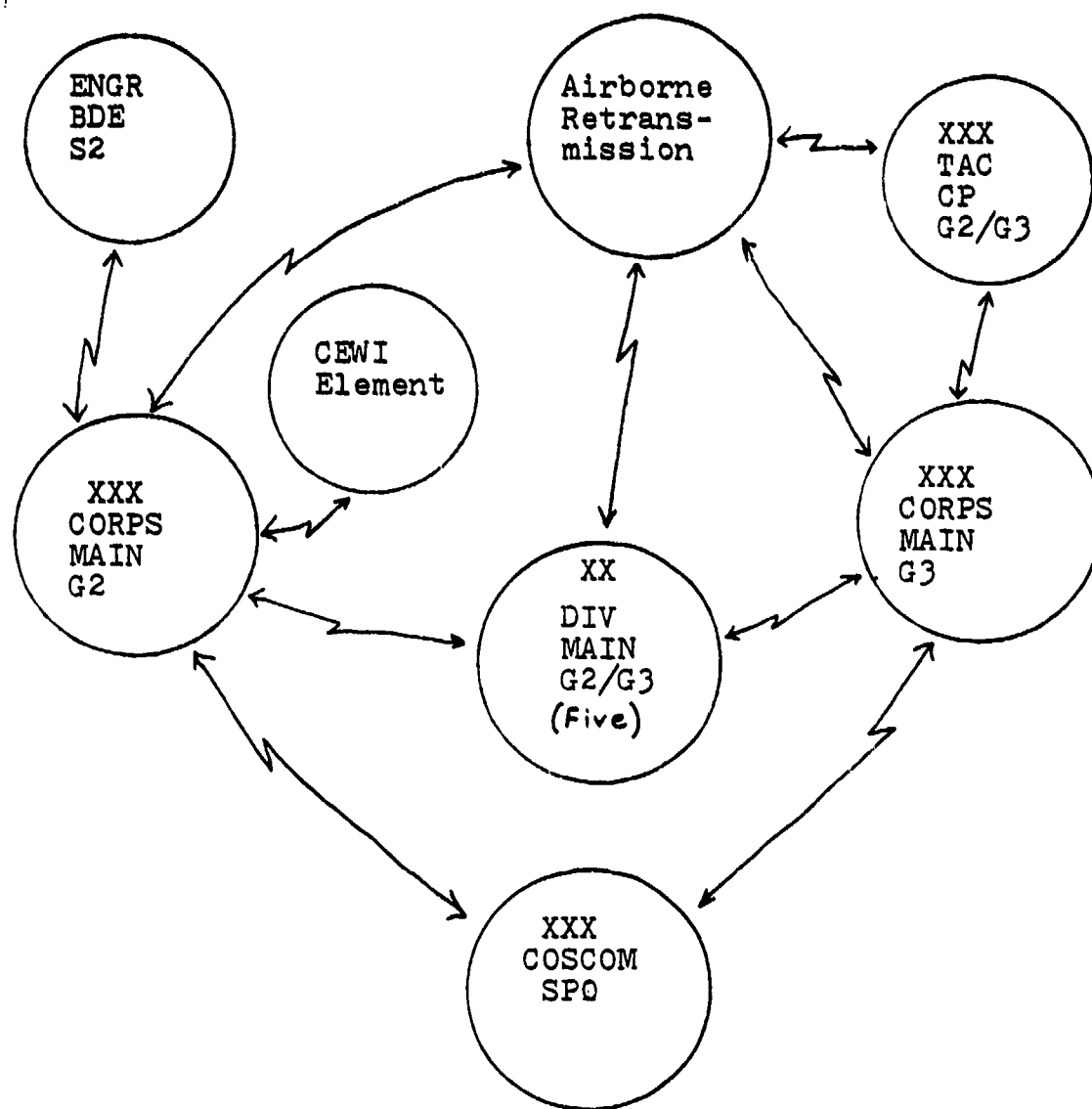
Source: Field Manual 11-92

Figure 4-4. Type Corps Radioteletype Nets.



Source; Field Manual 11-92

Figure 4-5. Type Radio-Wire Integration Stations



Note: G2 and G3 would be on separate frequencies and are Net Control Stations

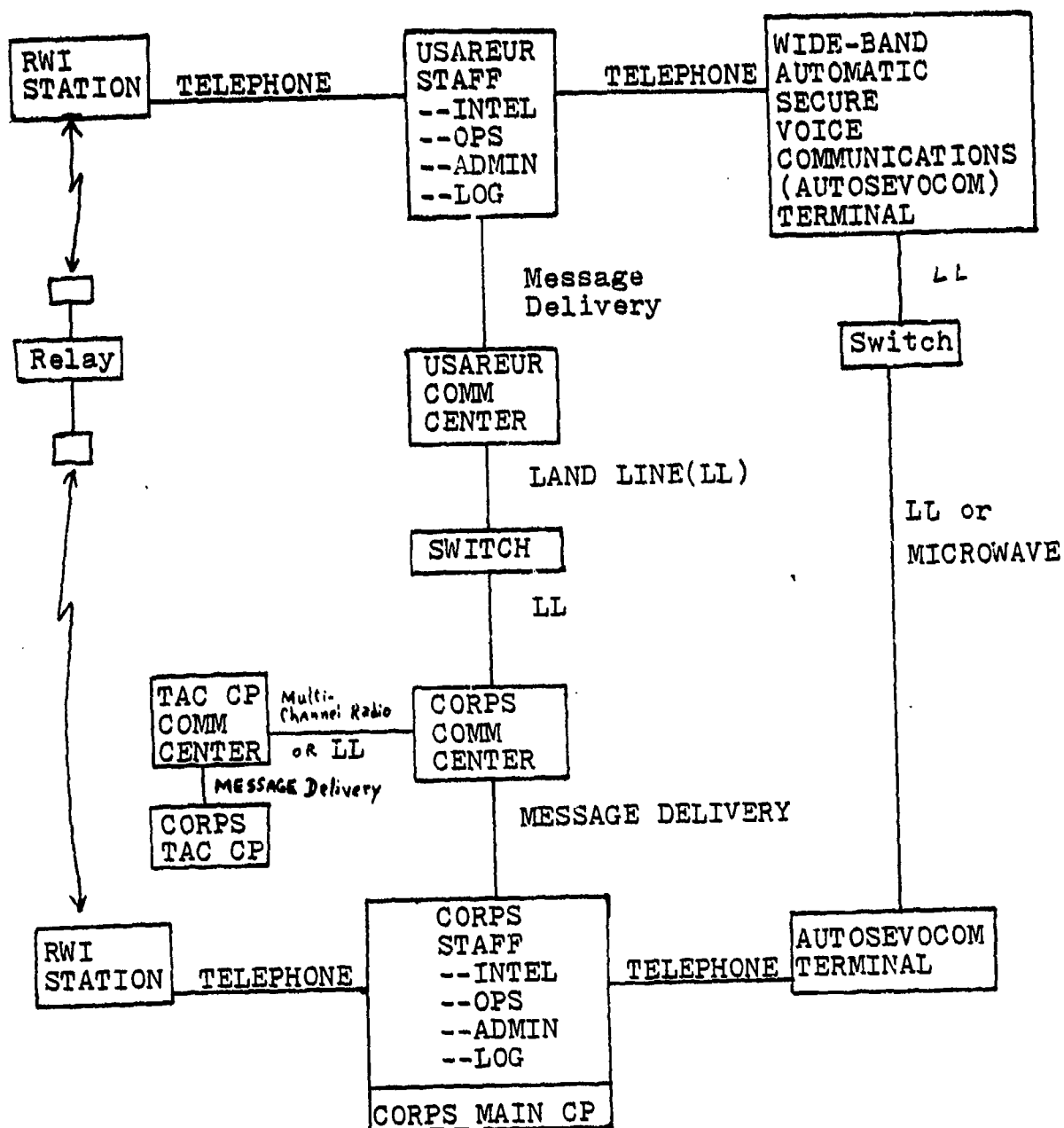
Source: Field Manual 11-92

Figure 4-6. Type FM Radio Nets

USAREUR and CENTAG normally communicate with the corps by network and point-to-point teletype landline circuits (sometimes using microwave radio links), radioteletype networks, voice telephone networks, and ground messengers. There is no current voice radio system between CENTAG and the corps. USAREUR has a voice broadcast radio system (Tactical Alert Net) with the corps in garrison, but does not currently deploy this capability during field exercises. Any intention to use this voice network during hostilities would be included in wartime OPLAN. These various networks are displayed in Figures 4-7 through 4-8.

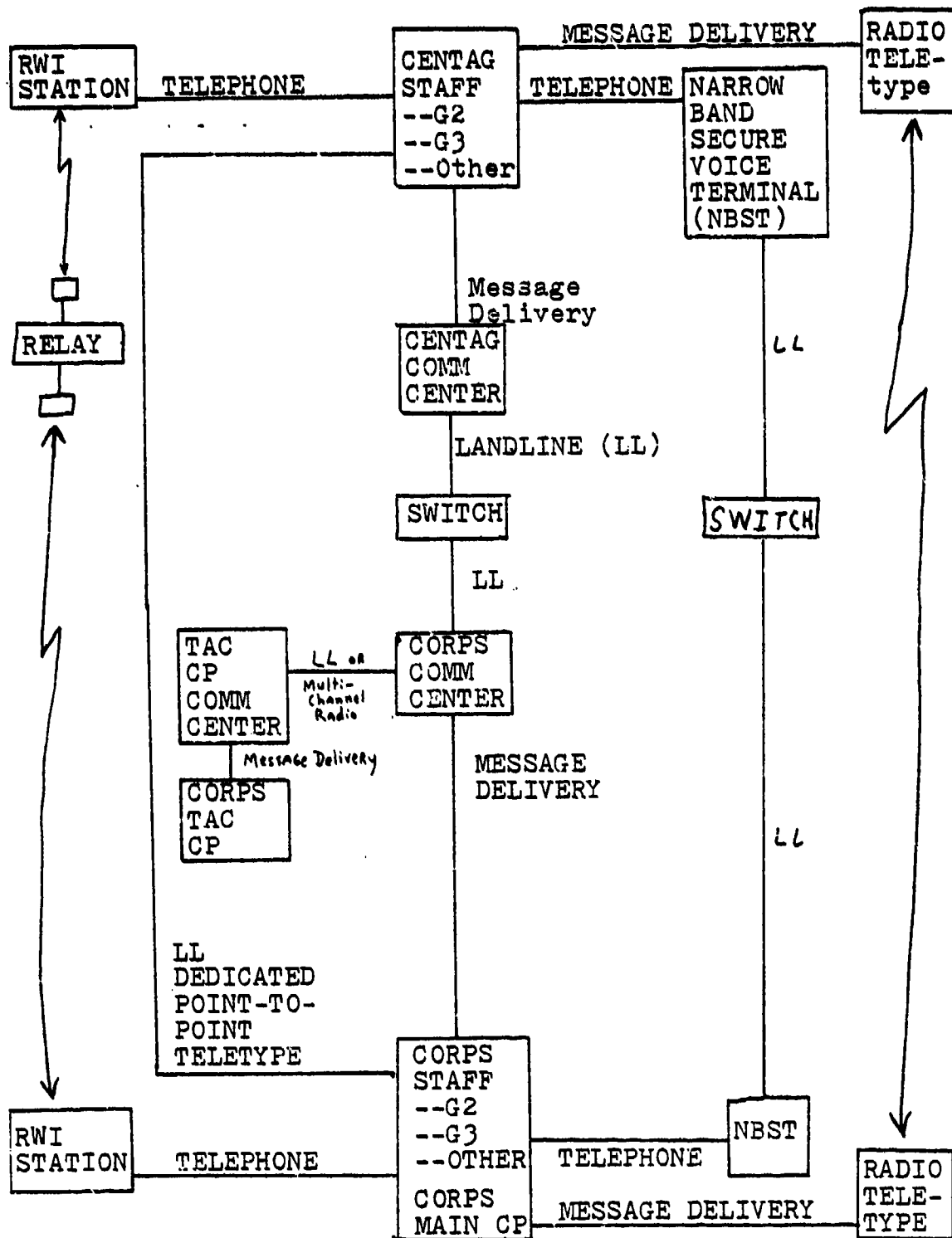
Communications Status

Much of the corps tactical communications in Europe is old in design, old in age, and insufficient in quantity. MG Latham, Deputy Commander, VII Corps, recently stated at an Army Operations Research Symposium that the corps needs more communications assets, more secure FM radio nets, and high-speed tactical teletype equipment. He also stated that components of new command and control systems being provided to the corps are too large and are currently not being hid well in the electromagnetic spectrum.⁴⁷ There are current programs intended to update the corps communications. Two TRI-TAC Program objectives for the Armed Forces are to achieve interoperability among tactical communications systems and other Department of Defense (DOD) telecommunications, and to field new tactical communications in a timely manner which use the most effective technology.⁴⁸ There are some NATO



Source: Personal experience of author

Figure 4-7. Communications between USAREUR and Corps



Source: Personal experience of author

Figure 4-8. Communications between CENTAG and Corps

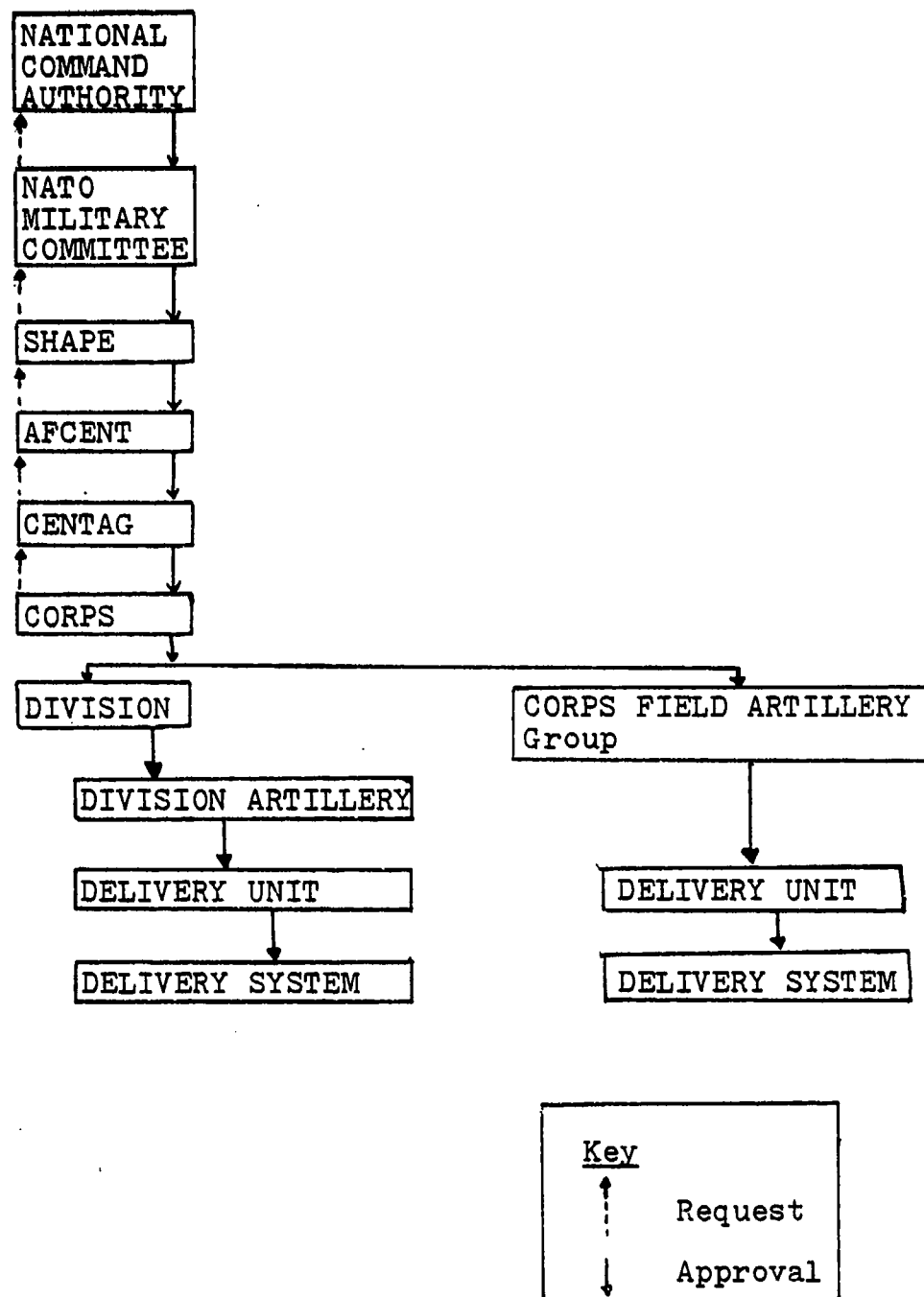
communications improvements currently under study or being implemented. For example, the Selected Employment Improvement Program has been focused on the testing of new high-speed communications systems between various NATO echelons above corps and also at the corps/numbered air force level.

Section V. NUCLEAR DEFENSE CONSIDERATIONS

There is very little discussion in any doctrinal literature concerning nuclear defense of corps command posts. Planning of current tactical communications networks and command post structure virtually ignores the possibility of nuclear war. This lack of doctrinal literature was described in detail in Chapter 2. Corps-level training exercises in Europe do not usually emphasize nuclear defense aspects; therefore, there is virtually no documentation generally available concerning nuclear defensive practices.

Section VI. US/NATO NUCLEAR RELEASE PROCEDURES

US national policy is that the authority for US armed forces to use nuclear weapons will be given only from the National Command Authority through the operational chain of command. This authority (nuclear release) may be based on a request from a corps commander or from any level above corps. The request and the approval are transmitted through NATO channels, since the NATO command structure forms the operational chain of command. See Figure 4-9. Advance planning is done so that "packages" of nuclear weapons are developed for employment of "...a group of nuclear weapons of specific



Source: Field Manual 100-5, p. 10-9.

Figure 4-9. Nuclear Request and Release Channels

yields for employment in a specified area, within a limited timeframe, to support a tactical contingency."⁴⁹ These plans for nuclear weapons employment must be continuously refined and updated in order to be effective. There is no doctrine to describe the means of communications by which requests and approval are transmitted; the actual means are based on classified operations plans and regulations. It can be inferred that these means can be any of the means shown in Figure 4-8. Whatever means are used for release, Field Manual 100-5 states that friendly troops must be warned of the planned use. It further states that dissemination of the warning "...requires an adequate and survivable command and control system."⁵⁰

Section VII. SUMMARY OF ANALYSIS

Corps Command Post Doctrine

There is very little US Army doctrine concerning corps command post structure. Whatever doctrine exists is still in draft form and is very sketchy. Many of the practices for establishing the structure and the deployment of corps command posts are based only on local SOP or OPLAN. The US Army uses three command posts routinely--Main, TAC, and Rear. The British and French use a Main and a Rear CP routinely, and deploy a TAC CP only at selected times. The Soviets use a Main, an Alternate, and a Rear CP, and deploy a TAC CP only at selected times. The West Germans use a Main and a Rear CP,

designate a subordinate headquarters as the site of an alternate CP if one is required, and do not use a TAC CP. The French, British, Soviets, and US all use a CP concept that has all elements of the Main CP in the same general area. The West Germans use a cellular concept with communications remoted up to 100 kilometers.

Combat Communications

Doctrine for combat communications within the corps is based on the deployment of corps command in the form of three command posts--Main, TAC, and Rear. There is no doctrine for communications from echelons above the corps, especially from NATO headquarters, but such communications are based on SOP or OPLAN.

Nuclear Defense Considerations

Detailed procedures for nuclear defense of the corps command posts are currently not stressed in doctrinal literature nor in field training exercises in Europe.

US/NATO Nuclear Release Procedures

Authority for specific employment of nuclear weapons is passed through operational command channels. The communications procedures for release are established by regulation, SOP, and OPLAN rather than by doctrine. The successful implementation of nuclear release authority requires survivable command, control, and communications systems.

Section VIII. CONCLUSIONS

This review of US Army doctrinal literature and selected procedures concerning division and corps command post operations was conducted to determine the degree to which they are based on criteria for survival on the integrated battlefield. This review revealed that the Army's tactical doctrine for corps command post operations on the integrated battlefield is not adequately defined. In view of these findings, it appears that one can partially accept the hypothesis that current corps command posts are not designed to be survivable on the integrated battlefield. When considering nuclear effects only, they are not designed to be survivable. When considering conventional effects only, they are designed to be survivable.

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7. Field Manual 100-5, Operations (with Change 1), Department of the Army, Washington, D.C., April 1977, p. 10-5.

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9. Training Circular 100-15, Corps Operations (Draft), initially circulated ca 1975.

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11. Field Manual 101-5 (Draft), p. E-1.

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CHAPTER 5

INADEQUACIES OF COMMAND POSTS ON THE INTEGRATED BATTLEFIELD

Section I. NUCLEAR WEAPONS EFFECTS

General

This section discusses some effects of nuclear weapons which would cause major damage to command post materiel and personnel. The actual effects in a particular case may differ from those discussed below, depending on levels of protection and other factors. In general, the effects discussed below are statistically sufficient for planning purposes.

Nuclear Radiation

1. Single dose exposure. Single doses of gamma or neutron radiation cause varying effects on personnel from illness to death. High dose levels, such as exposure to 8000 to 18000 rad, would cause death between 1-2 days; this is referred to as immediate permanent incapacitation. At lower levels of exposure, such as 650 rads or more, personnel would become functionally impaired within two hours and over half of an exposed group would die within several weeks; this is referred to as latent lethality.¹

2. Cumulative dose exposure. Some personnel may be exposed to radiation levels which are not in themselves harm-

ful immediately as a single dose. However, radiation exposure has cumulative effects on personnel. The US Army uses guidelines to determine minimum safety distances from the point of detonation in relation to risk levels to personnel previously exposed to some level of radiation. These risk levels are categorized as negligible, moderate, and emergency risk, and their effects are based on the previous exposure history of a unit or a person.² Radiation exposure states are shown in Table 5-1.

Thermal Radiation

This affects both materiel and personnel. Combustible organic substances may ignite, based on composition and distance from the point of detonation. For example, tent fabrics ignite at exposure to 13 calories of heat per square centimeter (cal/cm^2). Thus, tents would ignite at ranges less than 3 kilometers (km) from the detonation of a 35 kiloton (KT) weapon, and at less than 5 km from a 100 KT weapon.³ Unprotected personnel may receive third degree burns upon exposure to $6\text{--}9 \text{ cal}/\text{cm}^2$ from a 100 KT weapon at ranges less than 5 km.⁴

Air Blast

Damage to physical structures is caused by air pressure which is expressed in terms of "pounds per square inch (psi) of maximum overpressure." This effect varies with range and yield. Concrete structures begin to collapse at about 7 psi.⁵ Light trucks and vehicles may be overturned

Radiation Exposure State (RES)	Total Past Cumulative Dose (rads)
RES-0	None
RES-1	Up to 70
RES-2	From 70 up to 150
RES-3	More than 150

Source: Field Manual 101-31-1, p. 63.

Table 5-1. Radiation Exposure States.

at 5 psi, and light aircraft and helicopters can be severely damaged (depot maintenance required) at 2-3 psi.⁶

Electromagnetic Pulse (EMP)

This is an effect of electromagnetic radiation which increases very rapidly to an extremely high level, then decays. The characteristics of EMP vary by weapon yield and height of burst. EMP can permanently destroy electronic equipment by burning out circuit components through extremely high voltage applied in a short burst (20,000 volts per meter within 3-6 km of the burst for tactical weapons).⁷ It can cause temporary damage to electronics equipment by tripping circuit breakers or erasing computer memories.⁸

Other Effects on Communications

Black-out of radio communications may occur, lasting from seconds to hours, depending on the burst region and the mode of communications. This black-out is due to dust and fireball caused by the burst, and by an ionized region which affects radio-wave propagation.⁹

Section II. Inadequacies of Current Command Posts on the Integrated Battlefield

General

This section discusses primarily the deployment of the Main and TAC CP. The Rear CP, although its functions are important, will not be discussed. However, much of the discussion below could be applied to analysis of the Rear CP.

Location of the TAC CP

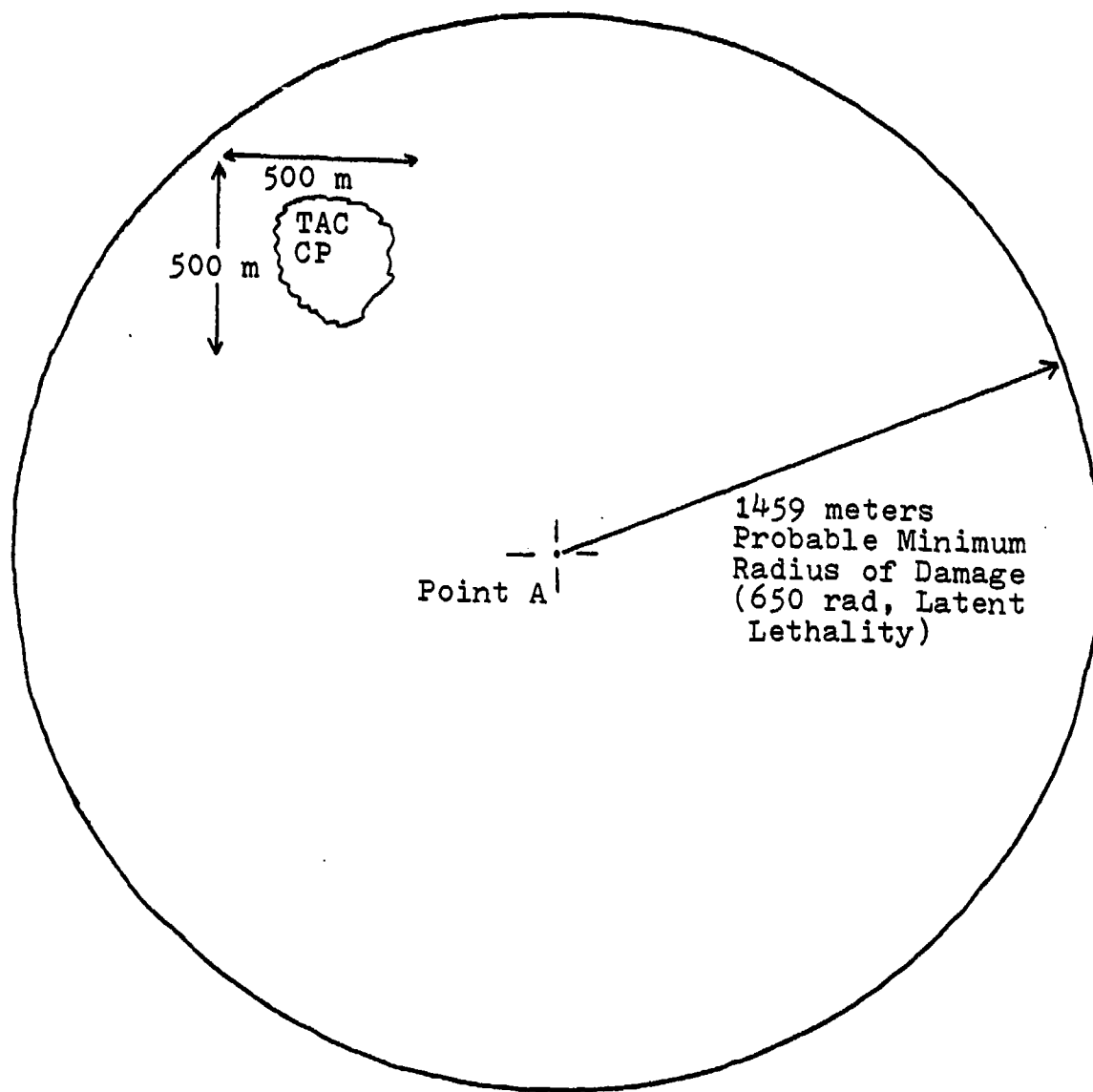
Doctrine states that the TAC CP provides the commander a command and control facility closer to his subordinates. In practice, this is construed to mean that the TAC CP is located in or close to the avenue of approach in which the enemy's main attack is expected to occur. On the conventional battlefield, this practice creates no real problem, since the corps TAC CP is out of normal enemy artillery range, except for FROG rockets and SCUD missiles with chemical and high explosive (non-nuclear) warheads. If these weapons with conventional warheads were used, they would probably not achieve total destruction of the TAC CP. They are degraded by target location error, delivery error, and lack of lethality to achieve total destruction of an area target. The communications facilities would be the most likely parts of the TAC CP to be acquired by enemy intelligence. However, on the integrated battlefield the corps TAC CP on a main avenue of attack may be more rapidly and accurately identified by the enemy. The Soviets will be conducting intense reconnaissance and surveillance along the main attack axis to locate command and control centers, nuclear-capable delivery units, and reserve forces in an attempt to destroy them.¹⁰ Soviet forward detachments will be operating well forward of the main body to exploit gaps formed by nuclear attack, presenting a threat to command posts located along the main axis of attack.¹¹ If the current TAC CP is located and then attacked by nuclear weapons, it will undoubtedly be totally

destroyed. The current TAC CP normally would occupy an area not larger than one square kilometer. It is designed to be deployed in M-577, tents, and soft-skinned vehicles. Such a target is within the probable minimum radius of damage of a FROG rocket with a nuclear warhead (650 rad--latent lethality at 1459 meters).¹² Figure 5-1 shows that the entire TAC CP would be within the probable minimum radius of damage if the FROG were to impact anywhere along the perimeter of the TAC CP area.

Dispersion

The Main CP is typically dispersed in a 10 km X 10 km area, as shown in Figure 5-2. On a conventional battlefield, this may be sufficient dispersion for protection against the effects of aerial attack or from SCUD missiles with chemical or high explosive (non-nuclear) warheads. The Main CP is usually located too far behind the forward edge of the battle area (FEBA) to be attacked by any other conventional weapons systems. However, on the nuclear battlefield, this dispersion may not be adequate. Radiation and blast effects will be the predominant causes of destruction due to lack of dispersion.

1. Radiation Effects. If the enemy locates the "signal park" by signals intercept/radio direction finding, he can compare this with available information, including terrain analysis, aerial reconnaissance (radar, photography, infrared) and other intelligence. He would most likely target areas in which signal, command post, and life/service



Source: Field Manual 101-31-3, p. 4-17.

Figure 5-1. TAC CP Deployment Compared to Lethal Area of FROG Rocket with 20 KT Nuclear Warhead

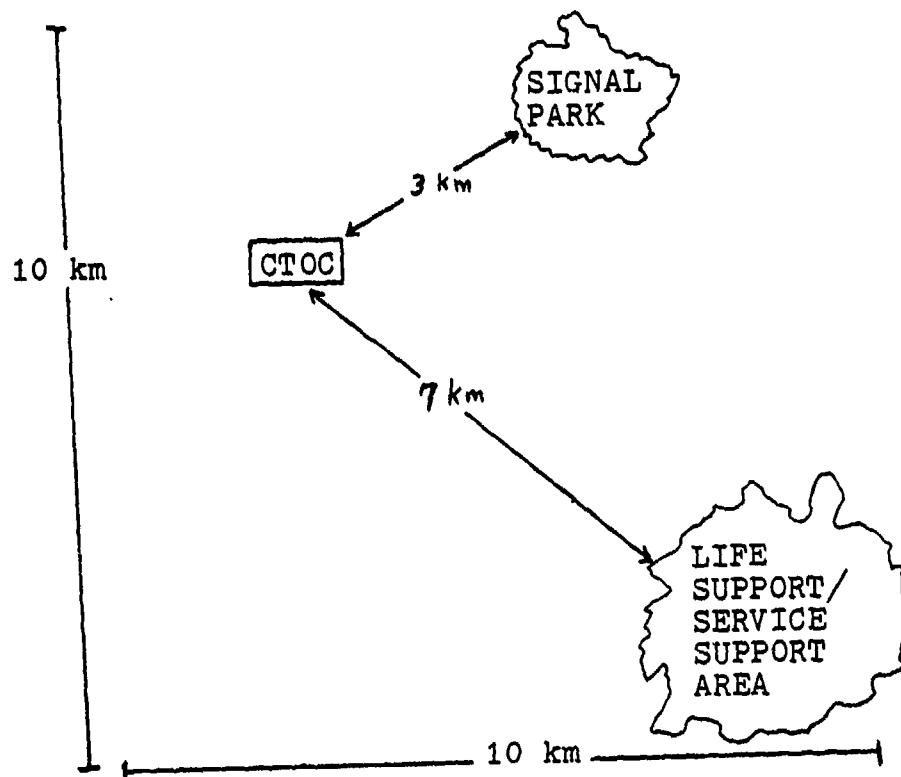
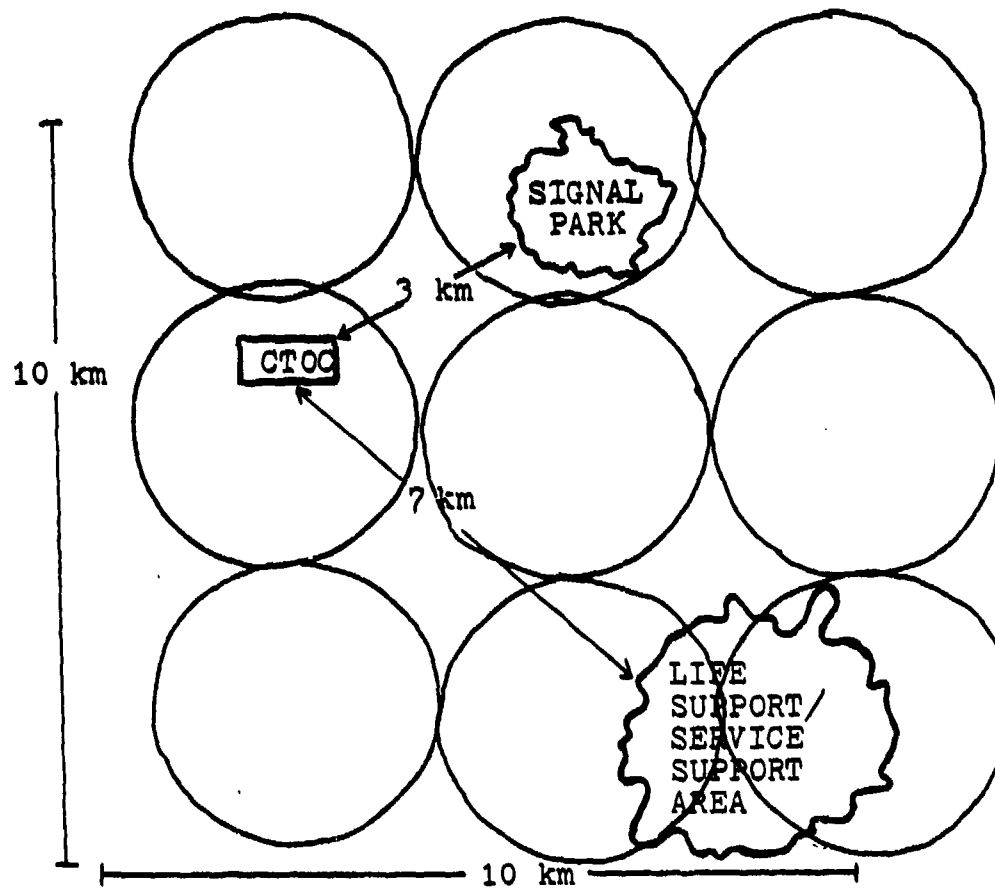
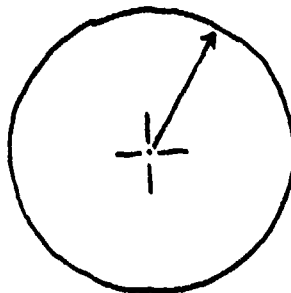


Figure 5-2. Dispersal of Main CP.

support areas might be located. He may not know which elements are located in the various target areas (except the location of transmitting antennas and radars), but he would probably consider this a valuable target for employment of nuclear weapons. He may analyze the target area to determine the effectiveness of SCUD missiles and how many weapons would be required to destroy the target. Nine to sixteen SCUD 100 KT weapons would be required to cover the entire target area with at least 500 rad initial radiation (latent lethality to exposed personnel).¹³ This is depicted in Figure 5-3. The Soviet combined arms army and tank army, either of which might oppose a US corps, contain a SCUD brigade of three battalions with three SCUD missile launchers each (total of nine missiles).¹⁴ The exact quantity of nuclear missiles in a SCUD brigade is not published in unclassified literature, but it can be assumed that more than one missile is available for each launcher. Thus, without much intelligence or targeting information, the Soviet combined arms army or tank army commander has the capability to at least cover the target entirely with 500 rad (latent lethality to exposed personnel), or can cover at least half of the target with 500 rad (latent lethality to personnel inside concrete buildings) within his current missile assets without seeking additional fire support from Frontal Aviation or the Front's SCUD brigade. As more accurate intelligence and targeting information becomes available, the required number of missiles could be decreased accordingly. The foregoing



Key



Latent Lethality
(650 rad)
1800 meter radius
of 100 KT Weapon

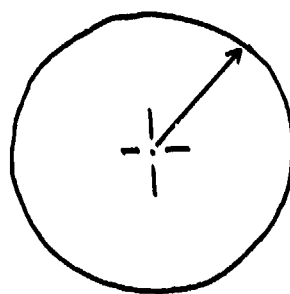
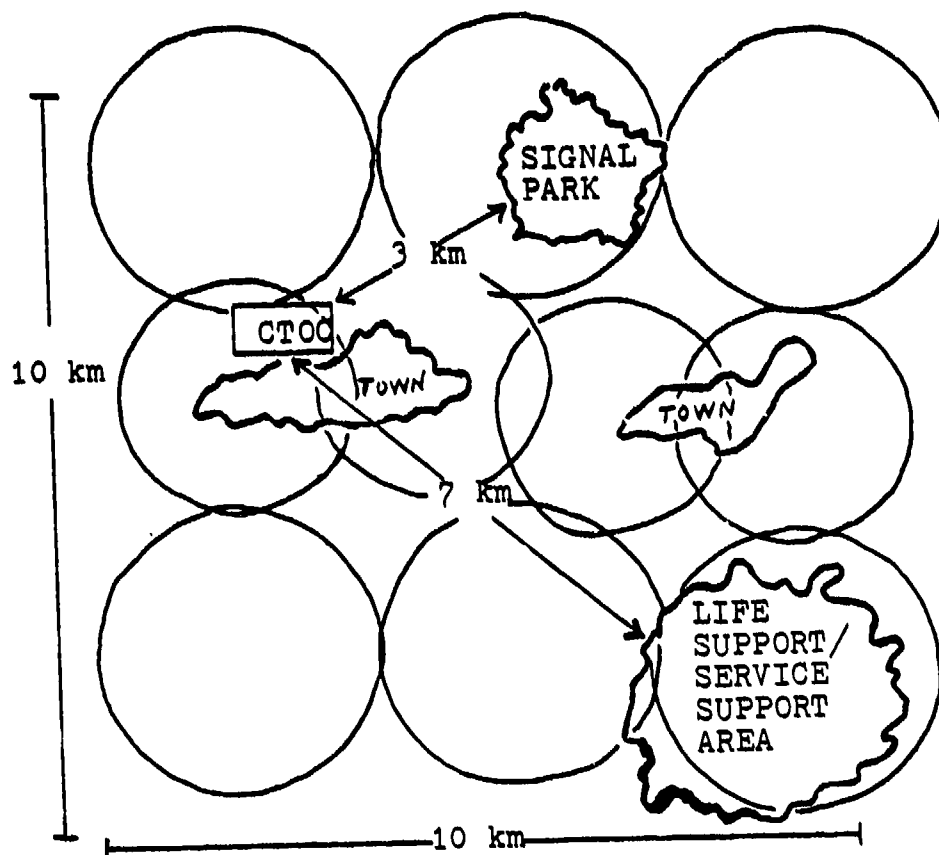
Note: If complete
overlapping cover-
age were desired,
16 weapons would
be required

Source: DA Pam 50-3

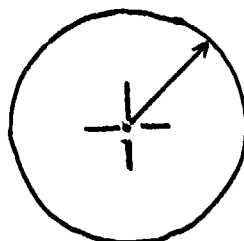
Figure 5-3. Nine SCUD, 100 KT Weapon Coverage of Main CP Area.

analysis assumes that the enemy would employ weapons with a 500 rad effect evenly throughout the area; however, this targeting could be more selective. For example, map inspection might show clusters of buildings are located in the town but very few buildings outside the town. Therefore, the intensity of weapons employed against the town as a target might be larger than the quantities employed elsewhere. A more likely number of missiles in this case would be determined to be only ten missiles or less, as shown in Figure 5-4. This is dependent also on topographic features, since there may be more than one town in the 10 km X 10 km area, or there may be terrain not suited for deployment, such as open fields, extremely rough or swampy terrain, lakes, etc.

The US Army calculates that friendly troops should be at certain minimum safety distances (MSD) from the intended detonation point (desired ground zero or DGZ) of friendly nuclear weapons. These MSD vary, depending on the degree of exposure which the friendly commander is willing to accept for his troops. For example, Table 5-2 shows that if friendly troops are warned and protected, then at least a range of 9900 meters from DGZ of a 100 KT weapon is required in order to be exposed to no more than negligible risk effect levels of radiation (0-70 rad). If they are at least 9000 meters away, but less than 9900 meters, they will be exposed to moderate risk levels (70-150 rad). If they are at least 4500 meters away, but less than 9000 meters, they will be exposed to emergency risk effect levels (greater than 150 rad).¹⁵



Latent lethality
(650 rad)
1800 meter radius
of 100 KT Weapon



1000 rad at
1500 meter radius
of 100 KT Weapon
in order to get
Latent Lethality
(650 rad) inside
Concrete Building

Figure 5-4. Ten SCUD Missiles Employed Against Main CP.

Protection Level of Personnel	Degree of Risk		
	Negligible	Moderate	Emergency
Unwarned, Exposed	23,300	21,600	14,000
Warned, Exposed	12,500	11,600	9,000
Warned, Protected	9,900	9,000	4,500

Notes:

1. All data is in meters.
2. This unclassified information is illustrative only. It is based on ranges from launch to point of detonation of 50-150 km. This is close to the range of SCUD-B (165 km with nuclear warhead).

Source: Field Manual 101-31-3, p. 4-23.

Table 5-2. Minimum Safety Distance, 100 KT Weapon.

This distance for each level of risk increases if personnel have been previously exposed to other risk effect levels, as shown in Table 5-3.

2. Blast Effects. There may be some additional personnel protection against nuclear radiation levels described above by locating command posts inside buildings. However, at a radius of 1680 meters from the detonation point, maximum overpressure is about 14 psi. A maximum overpressure of about 7 psi is sufficient to severely damage most concrete buildings.¹⁶ For example, a multi-story (3-8 stories) reinforced concrete building with reinforced walls will begin to collapse if it is closer than 1800 meters to the detonation of a 100 KT weapon. A multi-story (3-10 stories) reinforced concrete frame office-type building of earthquake resistant construction will begin to collapse if it is closer than about 1400 meters to the detonation of a 100 KT weapon.¹⁷ At these ranges (1400-1800 meters), exposed trucks can be overturned, communications shelters, microwave towers and dish antennas will be destroyed, the signal brigade's U-21 messenger aircraft on the ground will be destroyed.¹⁸

EMP Effects

The source region of EMP is generally located within 3-6 km from the burst.¹⁹ This will definitely have an adverse effect on all communications within the 10 km X 10 km area which are not properly shielded. This could occur in the area of the corps Main CP if only four weapons are detonated at

Radiation Exposure State	Total Past Cumulative Dose (rads)	Commanders Risk Guidance		
		MSD	MSD	MSD
RES-0	None	NEG	MOD	EMER
RES-1	Up to 70	NEG + 100m	NEG	MOD
RES-2	From 70 up to 150	NEG + 200m	NEG + 100m	NEG
RES-3	More than 150	NEG + 300m	NEG + 200m	NEG + 100m

Minimum Safety Distance can be obtained by using this table in conjunction with table 5-2. For example, if a commander wanted to maintain moderate risk and his unit is at RES-2, then the appropriate MSD is obtained by adding 100 meters to the MSD from table 5-2 for Negligible risk, using the appropriate data for the "Protection Level of Personnel". If personnel are warned, exposed, then add 100 meters to 12,500 meters.

Source: Field Manual 101-31-1, p. 63.

Table 5-3. MSD Modification as a Function of Previous Exposure.

four different aimpoints as shown in Figure 5-5. If nuclear weapons are detonated within 3-6 km of the CTOC or signal park, both temporary and permanent damage will occur to communications systems which are not properly shielded. The temporary damage to signal propagation, lasting minutes to hours, comes at the very time when radio rather than wire communications are most necessary to assess the status of subordinate maneuver units, to determine the status of subordinate nuclear-capable delivery units, and to coordinate air support using the air-ground operations system. In order to use these systems, some command and control personnel must also have survived the nuclear attack and still be operationally effective.

Movement

On the integrated battlefield, there will be contamination from a nuclear burst spread through fallout. The corps HHC is responsible for radiological monitoring of the area in which the corps headquarters operates. The instruments used to measure radiation may be inoperable due to EMP effects. If they are operating, they may be helpful in the decision concerning how and where a CP ought to be moved. However, the ability of the CP to move is the critical aspect that needs to be examined. The amount of radiological contamination can be estimated with sufficient accuracy to support decisions, but the ability of personnel to execute those decisions is dependent on a variety of factors. Some factors

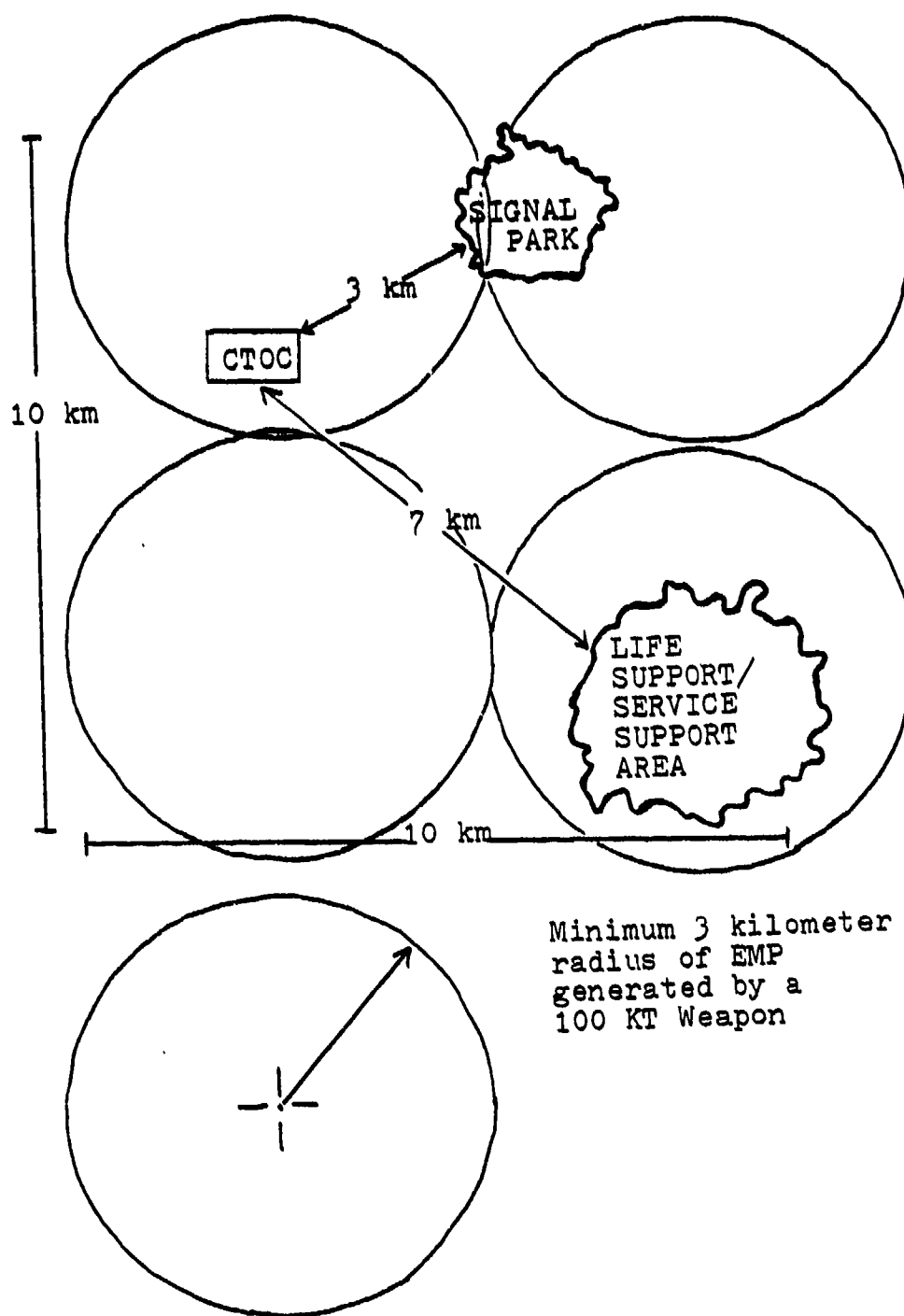


Figure 5-5. Effects of EMP generated from Four 100 KT Weapons.

to consider are: availability of transportation, damage to routes due to cratering, debris, and tree blow-down, and passage through forested areas and cities which are burning due to thermal radiation. Seriously injured soldiers must be treated and evacuated, further straining available transportation. The corps HHC can move approximately 18% of its personnel and 30% of its equipment and supplies using one lift by organic assets.²⁰ It receives additional transportation support from the corps support command. This might be timely enough on the conventional battlefield, but in a nuclear environment, the lack of ability to move rapidly from a contaminated area into non-contaminated areas could be fatal. Current use of standard Army buses for transportation might be good for conventional operations, but they would have extreme difficulty in traversing the integrated battlefield with its mass fires, debris, and tree blow-down.

Redundancy

If the Main CP were attacked successfully by nuclear weapons, the TAC CP would have to assume command and control of the battle, assuming the TAC CP were still operational. The TAC CP, as currently configured, monitors the progress of the battle primarily by obtaining summaries of the friendly situation and the intelligence situation from the corps Main CP. When the Main CP has command, the TAC CP does not have a means to monitor the reports of subordinates. The maneuver divisions report timely information concerning the friendly situation and enemy operations to the corps Main CP

by secure voice on the multichannel radio system.

Intelligence collectors at corps and echelons above corps provide timely targeting information to the corps G2, who in turn passes it to the corps fire support element for relay to the division fire support element or to the corps artillery (LANCE battalion) using multi-channel voice radio. In field conditions, there is not enough time to provide duplicate voice reporting to the TAC CP within the constraints of existing personnel and communications assets. Intelligence flows from collection units and platforms to the corps Main CP, either direct or through a collocated supporting intelligence unit (CEWI group, ASA battalion, or military intelligence detachment). After intelligence reports are analyzed, the important aspects are provided to the TAC CP in summary form. There are no direct coordination links between intelligence collection management personnel at the TAC CP and the collecting units/platforms outside the corps.

The corps G3 plans office develops contingency plans or operations plans, then passes a copy to the TAC CP. The TAC CP personnel are not usually involved in the planning stages of any operation.

The air-ground operations system is operated from the Air Support Operations Company (ASOC) at the Main CP. There is currently no duplicate set of equipment with which the ASOC can operate from the TAC CP.

The communications section below will describe the communications which affect the exercise of command and con-

trol from the TAC CP. Suffice it to say here that on the conventional battlefield, the communication network of the corps Main CP supports the TAC CP. On the integrated battlefield, this communications support will most likely be cut. The TAC CP is not a true alternate CP and therefore if the Main CP is totally destroyed, the TAC CP cannot perform all of the Main CP functions. The TAC CP may have command of the corps, but it will most likely will not have control of the battle for long without the supporting communications.

Section III. COMMUNICATIONS

General

This section addresses some of the more serious communications problems to be encountered on the integrated battlefield. It does not address detailed technical aspects of communications employment, but rather the broad aspects of survivability and continuity of operations supporting the command and control systems of the corps command posts.

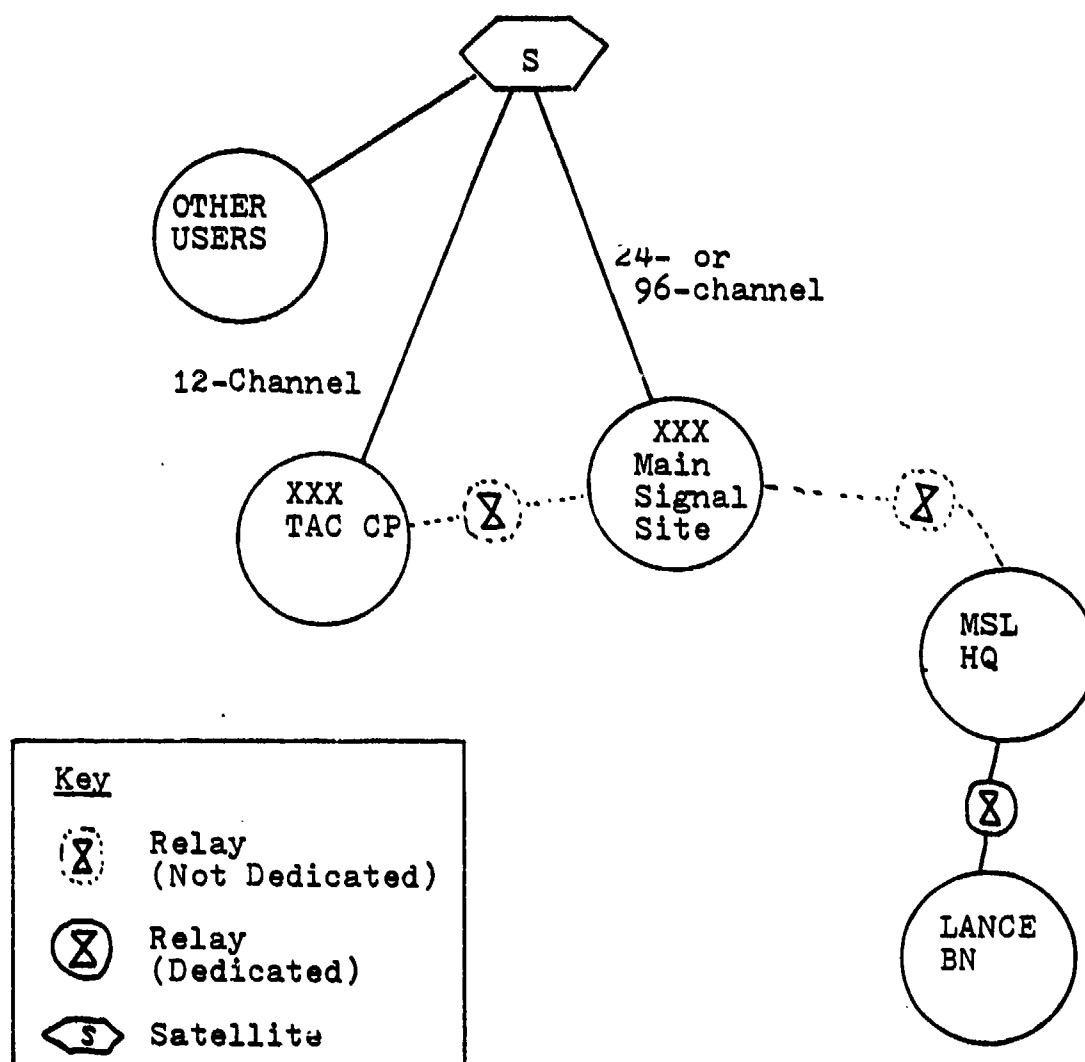
Continuity

1. TAC CP Communications. Current doctrine, current equipment, and documents addressing developmental systems all have one thing in common--the communications provided to the corps TAC CP are less than half of those provided to the Main CP. If the Main CP is destroyed by nuclear attack, the TAC CP physically does not have the communications assets to duplicate all the Main CP communications networks. For example,

sufficient tactical satellite (TACSAT) terminals (AN/TSC-85) will be located to support the Main CP with two 96-channel and one 24-channel systems; the corps TAC CP will have one AN/TSC-93 used to establish one 12-channel system. Additionally, this one 12-channel system must go through corps Main CP to communicate with adjacent corps, the air force air-ground system, and most importantly, the missile headquarters controlling the nuclear capable LANCE battalion.²¹ This is illustrated in Figure 5-6. The multi-channel relay from the TAC CP to the Main CP is not even a dedicated relay in this concept. During 1979, tests of the AN/TYC-39 () (V) Automatic Message Switching Central assumed that the TAC CP would not be required to handle the same message volume as the Main CP. The Main CP was provided 50-line message switches, while the Jump CP (TAC CP) was provided one 25-line switch.²²

2. Termination of Circuits to Support Targeting.

There is no doctrine concerning the systems to support the flow of intelligence from collection assets at corps level and above to the corps artillery and division artillery assets in Europe. In general, intelligence communications are established from collection agencies or systems to the G2 at corps Main CP, who passes targeting information either to the corps fire support element or to subordinate division G2 for appropriate action. This process and information flow is displayed in Figure 5-7. This is a time consuming procedure and information concerning moving/highly mobile



Source: Field Manual 11-92, p. D-1.

Figure 5-6. Proposed Corps Command Multichannel System Using Satellite Communications

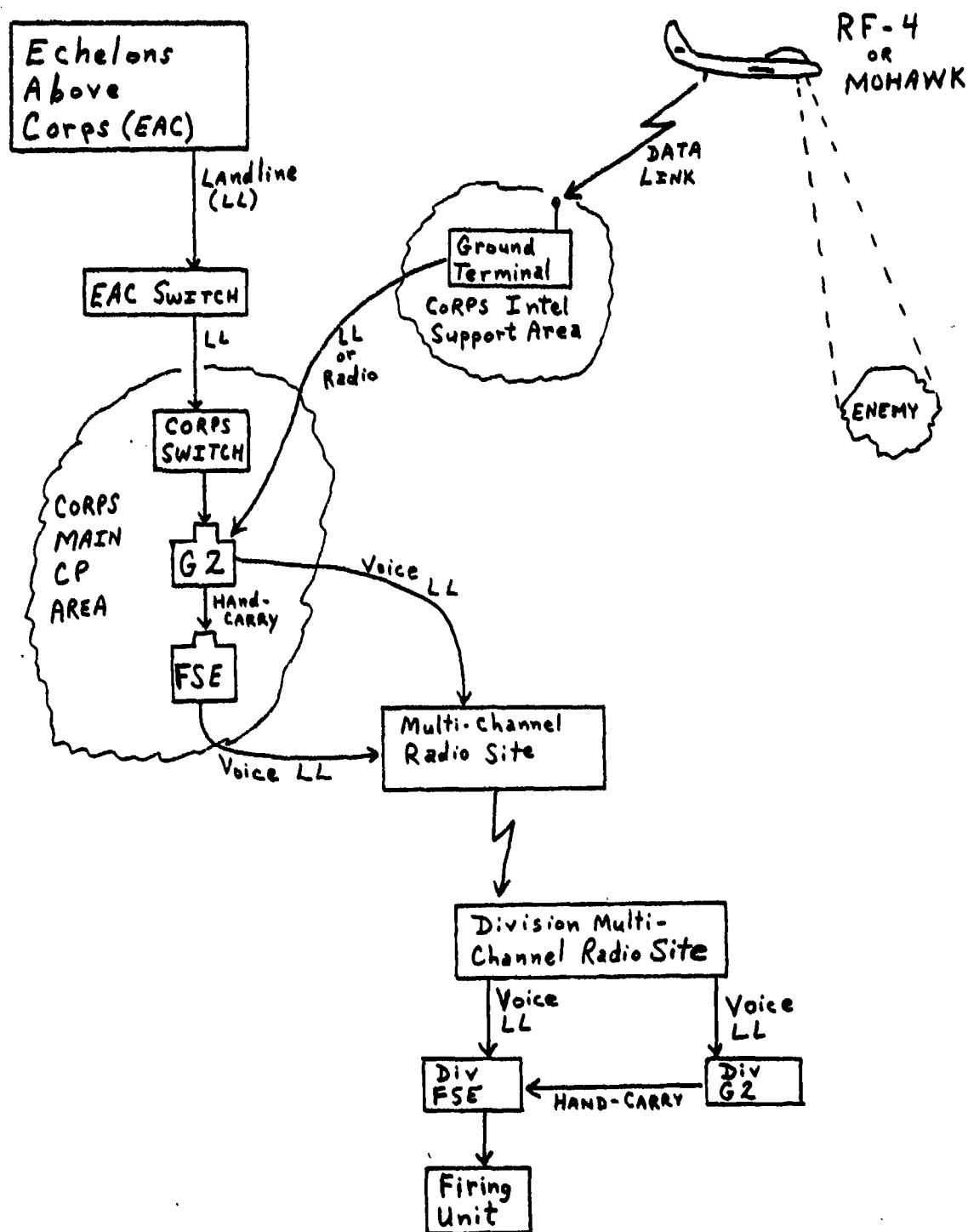


Figure 5-7. Sample Intelligence Targeting Information Flow and Communications

targets may be obsolete by the time it arrives at the appropriate artillery firing battery. Considering NATO's small yield ground nuclear weapons systems, and the political constraints on nuclear targeting, this time lag is unacceptable. If the corps Main CP switch is destroyed, then targeting intelligence from echelons above the corps is effectively terminated, since the TAC CP and the artillery systems receive this information through that switch. In practice, there is some multichannel redundancy provided by the corps area signal centers with echelons above the corps using alternate routing for these systems. This is usually a procedural affair to enable communications with the Main CP. If communications with the Main CP were out, then the flow would be shifted to the TAC CP.

There is no such doctrinal redundancy currently for corps intelligence assets, which report to the intelligence facility supporting corps Main CP, such as GUARDRAIL, MOHAWK SLAR, Photo, and Infrared, and QUICKLOOK. The CENTAG Tactical Aerial Reconnaissance Results Reporting System terminates at corps Main CP only; the communications system is a "manual tape-relay" process from corps to divisions, as shown in Figure 5-8.

Radio Direction Finding (RDF)

RDF decreases in accuracy as range increases. However, the Soviets employ aircraft platforms for electronic reconnaissance.²³ Therefore, they can find a US communica-

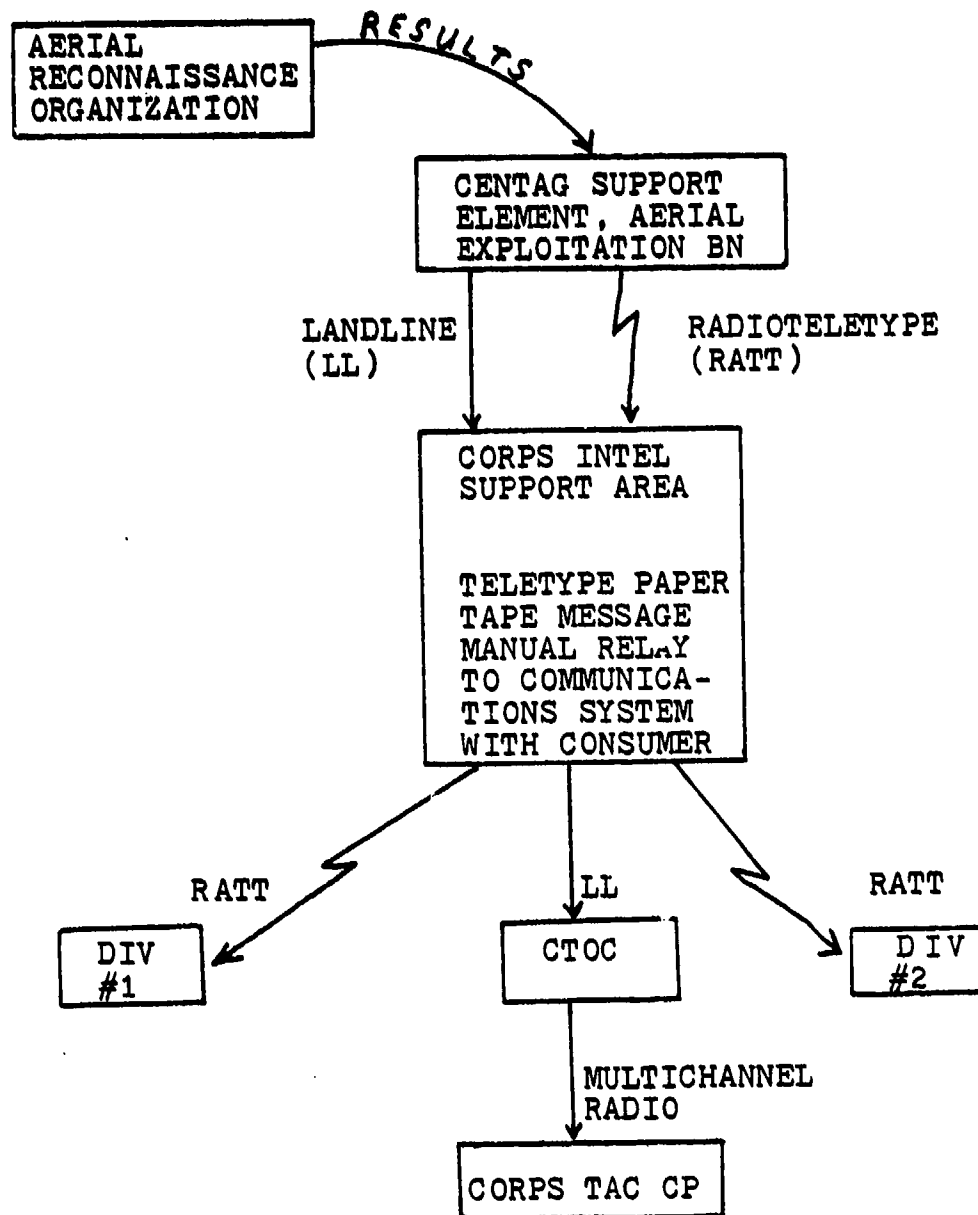


Figure 5-8. Tactical Aerial Reconnaissance Results Reporting System.

tions site by flying within closer collection range than that range from which ground based assets can collect. US signal intelligence assets can intercept Soviet command, control, and intelligence communications at ranges in excess of 50-100 km, and can locate Soviet artillery, surface-to-surface missiles, and air defense artillery at these ranges.²⁴ This same collection capability can reasonably be attributed to the Soviet signal intelligence/electronic reconnaissance organizations, especially since they are using aerial platforms. Within three minutes, Soviet electronic reconnaissance organizations can intercept, process, and target US radio transmissions lasting less than one minute.²⁵ Due to the long distance between the corps Main CP and the FEBA, air attack is the only timely means available on the conventional battlefield to use against detected signal sites supporting the CP. On the nuclear battlefield, the same signal sites could be attacked with nuclear weapons delivered by SCUD missiles. Thus, radio direction finding, even if not extremely accurate at longer ranges, becomes more of a threat to the communications systems on the integrated battlefield. Targets can be attacked with a high probability of success based on less accurate positional data than that required for conventional weapons systems.

Frequency of Movement

Signal sites supporting a corps Main CP do not usually move more frequently than the command post. Field Manual

11-92 (Advance Copy) states:

Those command posts which must transmit frequently will have to move frequently in order to survive; ideally within minutes of lengthy trans-²⁶ missions if the CP is within enemy artillery range.

This prescription was undoubtedly written with the conventional artillery range (30 km) in mind. The communication support for the corps Main CP is out of this range, but it is still within range of a SCUD missile (165 km nuclear, 280 km conventional).²⁷ The corps Main CP makes continuous radio transmissions and would be constantly moving if the above prescription were followed. The corps CP cannot move too frequently, since much of the supporting communications equipment takes several hours to set up and tear down, excluding travel time. For the mean time to set up an AN/TYC-39 switch and associated communications security equipment is 3 hours, 30 minutes (assuming the communications node is previously set up and fully operational prior to the arrival of the AN/TYC-39. The mean tear-down time is 1 hour, 9 minutes.²⁸ If two moves were made in one day, the system would be operational less than 14 hours per day.

Section IV. SUMMARY OF ANALYSIS

Threat

The most likely enemy weapon to be used against the corps Main CP on the integrated battlefield is the SCUD missile with a 100 KT warhead or its replacement. The most

likely enemy weapons for use against the TAC CP are the FROG rocket or the SCUD missile.

TAC CP

1. The TAC CP located in a division sector and in a main avenue of enemy approach is highly vulnerable to intense enemy reconnaissance in this area on the integrated battlefield.

2. The TAC CP provides no true alternate command and control facility for the corps Main CP.

Main CP

If the Main CP, as currently configured, were attacked by nuclear weapons of 100 KT yield, it would most likely be permanently destroyed (unable to perform its mission) due to a lack of dispersion and to a lack of protection from blast and nuclear radiation.

Communications

1. The communications system supporting the corps is not sufficiently redundant to support the TAC CP and nuclear firing units with timely targeting intelligence from collectors at corps and echelons above corps.

2. The radio direction finding threat to the communications system supporting the corps is more dangerous on the integrated battlefield, since nuclear weapons can be employed with target location data that is less precise than that required for conventional weapons employment.

Effectiveness

Command posts may be made survivable by dispersing, but probably would not be continuously effective to control operations in a timely manner due to lack of proper communications support and redundancy.

Section V. CONCLUSIONS

The corps TAC and Main CP as currently configured and deployed are neither dispersed nor redundant enough to survive a nuclear attack by SCUD missiles, or FROG rockets in the case of the TAC CP. If a Main or TAC CP were attacked by SCUD missiles, the effects on personnel may not be 100% killed, but the effects of blast overpressure on communications equipment and the effects of exposure to latent lethality (650 rad) levels of radiation would cause sufficient incapacitation of personnel that the command post could not perform its mission--command and control.

This supports the hypothesis that current corps command posts would not be survivable and continue to be effective on the integrated battlefield based on their vulnerabilities to the effects of nuclear weapons.

ENDNOTES

1. Field Manual 101-31-1, Nuclear Weapons Employment Doctrine and Procedures, Department of the Army, Washington, D.C., March 1977, pp. C-7 to C-9.
2. Ibid., p. 63.
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CHAPTER 6

PROPOSED SOLUTIONS

Section I. GENERAL

The previous chapter highlighted some major areas where the current corps command post concepts would be inadequate on the integrated battlefield. This chapter describes the author's proposed solutions to those inadequacies. The proposals address architecture of the command for 1986 to 1990. In the combat developments and materiel acquisition processes, the first step in documenting an Army requirement is to "...identify those mission elements for which existing or projected capability is deficient and to identify opportunities for capability enhancement through more effective and less costly methods and systems."¹ This documentation is required to be stated in "terms of the operational task to be accomplished...not in terms of capabilities and characteristics of a hardware or software system."² This chapter discusses the basic operational needs which form the foundation for the identification of alternative system concepts. In some areas, the need will be for procurement of additional quantities of equipment already in development; this is based on different organization and procedures than those on which the existing procurement quantities are based.

Section II. DESIGN AGAINST THE THREAT

The Threat

Design of a corps command post for operation on the integrated battlefield should be based on the weapons systems which present the most likely threat to the corps Main CP. There are a variety of weapons which can be employed, depending on the tactical situation. The corps Main CP would most likely be deployed about 70-100 km from the FEBA. Command posts in this area are vulnerable to actions of long-range reconnaissance patrols, guerillas, sabotage by partisans, and forward detachments of the attacking army. If Soviet forward detachments were operating that far forward and locate the command post, the threat is basically from ground direct-fire weapons systems (tanks, machine guns, small arms). If enemy intelligence operations locate the CP, the enemy could attack it with nuclear weapons delivered by tactical aircraft or guided missiles. The Soviet forward detachments would most likely be deployed to depths greater than 50 km after the Soviets delivered their nuclear weapons in order to rapidly exploit the effects on NATO forces. In this case, they do not represent a threat greater than that presented by the nuclear weapons, since most of the damage would have already occurred. If the Soviets decided to use air-delivered nuclear weapons, the targeted CP may have moved during the time it takes to coordinate an air-delivered nuclear attack between the combined arms army, the Front, and the

tactical air army supporting the Front. The air defense posture of NATO forces may pose great risk to enemy air forces attempting to deliver a nuclear weapon on a target such as a corps Main CP. The SCUD missile could be employed more rapidly against a corps CP than an aircraft delivered nuclear weapon. The Soviet army commander can employ the assets from his organic SCUD brigade, eliminating the need for Front and tactical air army coordination. Employing a SCUD missile would not entail the risk to the Soviets that air-delivered nuclear weapons would, i.e., loss of delivery aircraft.

SCUD Missiles

Employment of SCUD missiles against a corps Main CP, an area target, would not require the pinpoint accuracy provided by aircraft delivery. There would be little or no warning of an impending enemy missile attack, whereas enemy aircraft could be detected at long ranges and engaged by air defense weapons. The survivability characteristics of a corps Main CP should be designed to minimize the effects of the SCUD missile(or its replacement) with a nuclear warhead. The nuclear weapons effects discussed in this chapter are based on the capabilities of the SCUD missile. These capabilities are derived from unclassified references and may not represent the true capabilities of the SCUD missile or its potential replacement on the 1986-1990 integrated battlefield. However, they provide the basis for discussion of corps CP architecture that is sufficiently accurate to highlight current de-

ficiencies and initiate statements of operational needs based on the Soviet nuclear threat. The SCUD missile's nuclear warhead discussed in this paper is about 100 kilotons (KT).³

Section III. DISPERSION

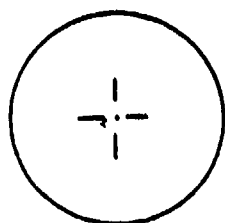
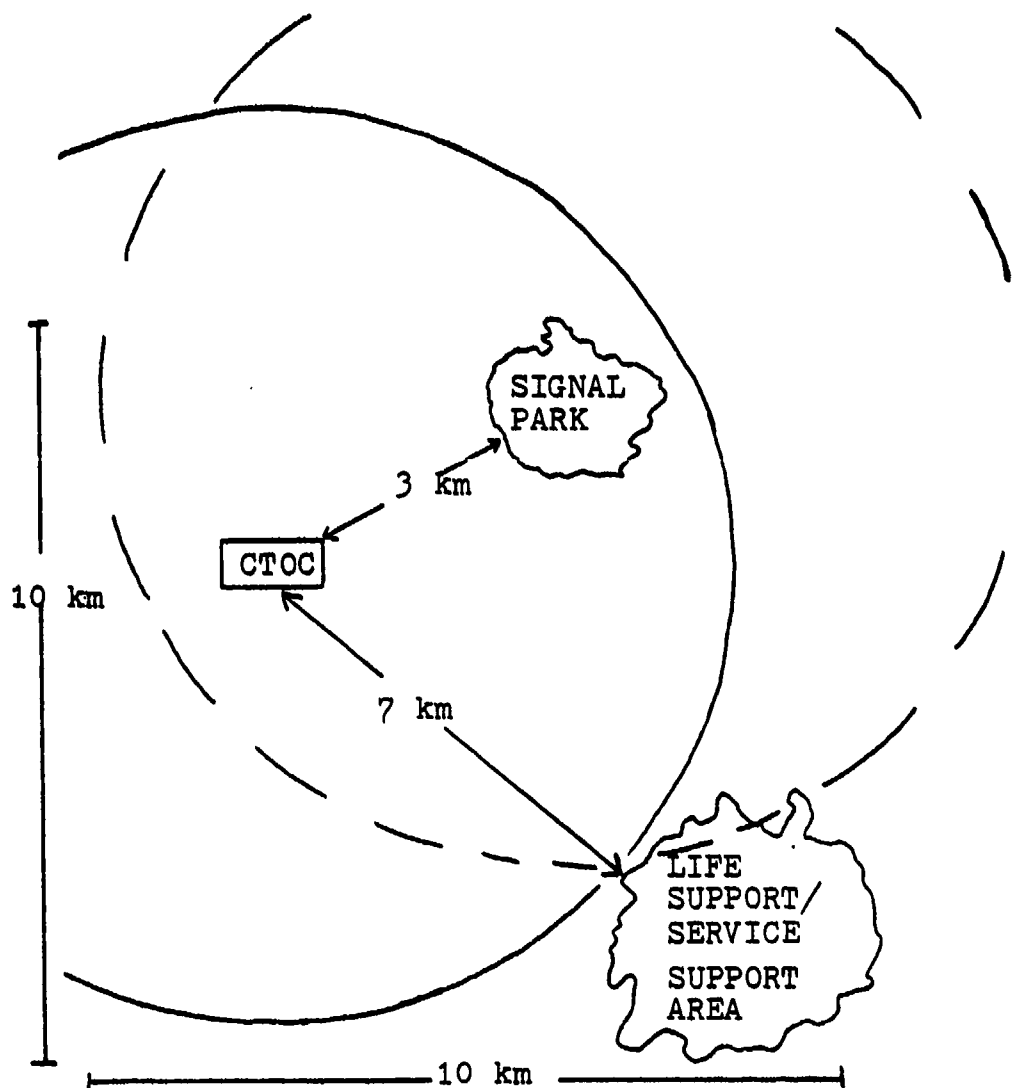
General

Measures for defense against nuclear radiation and blast effects are inadequate in the current corps command post doctrine. There have been some attempts at dispersing the command post, such as remoting communications sites from the CTOC. However, if the distance between these remote sites and the CTOC is less than two lethal radii of a nuclear weapon, then both facilities can be attacked by nuclear weapons using a single aimpoint. An analytic model developed by Sidney I. Firstman describes sites dispersed by about 0.2 lethal radii as point targets. Sites dispersed between 0.2 and 2.0 lethal radii can be attacked as one target using a single aimpoint, although multiple weapons may be used to insure target defeat at a specified criterion.⁴ Attempts to disperse a command post by 2 or 3 kilometers may reduce its vulnerability to target acquisition, but not necessarily reduce vulnerability to nuclear weapons effects.

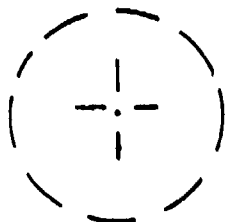
Defense against Blast Effects. A 100 KT nuclear weapon generates 7 psi maximum overpressure at approximately 2600 meters radius from point of detonation.⁵ Concrete buildings within this area will begin to collapse under these conditions.

If a CTOC communications site complex were deployed in buildings, susceptibility to being targetted as a single aimpoint with overpressure as the dominant effect can be reduced by deploying these facilities at least 5200 meters (2 lethal radii) apart. If a CTOC-communications site complex were deployed in tents and vehicles, the separation distance increases. Light vehicles are affected adversely at 5 psi maximum overpressure: for a 100 KT weapon, one lethal radius for 5 psi effects is 3200 meters. Separation distance becomes 6200 meters. For the deployment illustrated in Chapter 5, Figure 5-2, the CTOC-communications site complex would be within 2 lethal radii, but the life support service support area would be outside this area (Figure 6-1).

Defense against Radiation Effects. The lethal radius of nuclear radiation (greater than 500 rad) for a 100 KT weapon is approximately 1800 meters. Two lethal radii are 3600 meters. However, dispersion should not be based on this calculation alone, since the two lethal radii calculation is merely intended to present multiple aimpoints rather than a single aimpoint for the Main CP. A more appropriate calculation for dispersion would include the minimum safety distance (MSD). MSD is a calculation normally used when a nuclear weapon is to be employed by friendly forces. MSD is the sum of the radius of safety for a specified degree of acceptable risk and vulnerability, and a delivery error buffer. Although this is normally used when planning friendly strikes, dispersion based on this calculation provides better protection for the command post since it includes an analysis of the risk



Radius of 6200 meters is two Lethal Radii of 100 KT Weapon (Latent Lethality). Aimpoint is Center of CTOC,

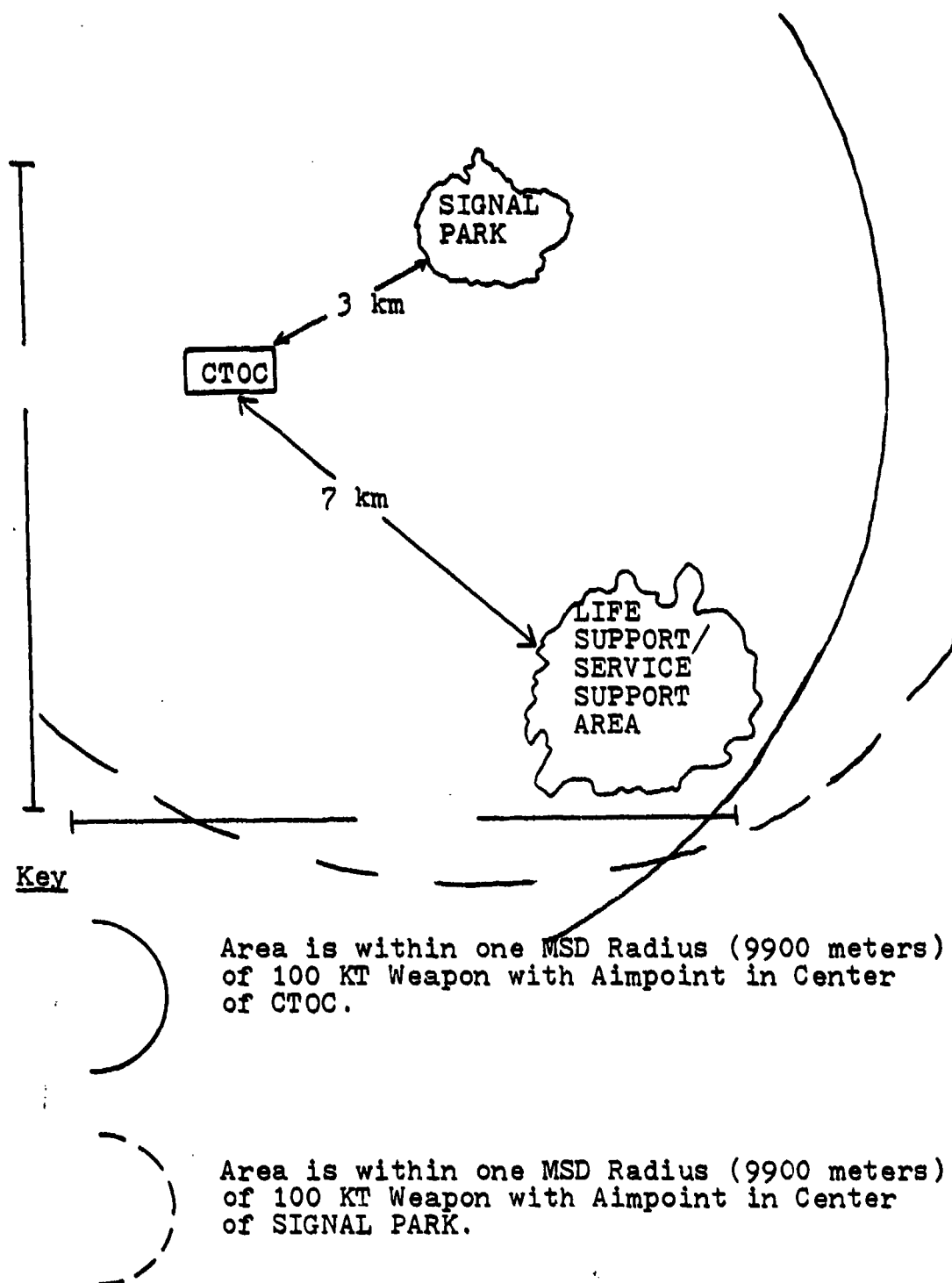


Radius of 6200 meters is two Lethal Radii of 100 KT Weapon (Latent Lethality). Aimpoint is SIGNAL PARK.

Source: DA Pam 50-3.

Figure 6-1. Analysis of Current Corps Main CP using Two Lethal Radii Calculations.

faced by the commander for accepting troop exposure levels based on cumulative dosages. One cannot always expect the enemy to find the exact center of a target, nor can one expect that a weapon would detonate exactly at the desired aimpoint. Use of the MSD calculation takes those factors into account, but more importantly, use of MSD calculations provides consideration for previous exposure of the command post personnel. Such an analysis might focus on the "negligible risk" category for warned, protected personnel. Since personnel in a command post are not required to hold key terrain or join battle with major enemy combat units, there is little rationale for using "moderate" or "emergency" risk categories. One lethal radius for negligible risk to warned, protected personnel is 9900 meters. The corps Main CP' life support service support area of Figure 5-2 is within one lethal radius using this criterion (Figure 6-2). Lethality at this level of exposure is based on cumulative dose rather than on one single dose. This concept would require dispersion of 19,800 meters in order to achieve a two lethal radii separation. Such a concept is vital for CP survivability because it focuses on cumulative dose. If the personnel manning the CP are to remain effective after more than one exchange of nuclear weapons, then cumulative dose rather than single dose becomes the major factor in dispersion. Many analyses of vulnerability to nuclear weapons effects examine only a one-time exposure to nuclear radiation. However, there will probably be



Source: Field Manual 101-31-3, p. 4-23.

Figure 6-2. One MSD Radius of 100 KT Weapon.

several times when personnel manning the CP are exposed to a sufficient level of radiation to be lethal when accumulated over a short time. Dispersion based on "Minimum Safety Distance" and "two lethal radii" calculations rather than on "latent lethality" calculations tends to decrease the amount of exposure to which the CP as a whole is vulnerable, while increasing the time over which the CP personnel can be expected to function unimpaired.

Methods of Dispersion. Figure 6-3 illustrates the Main CP

dispersed using MSD calculated separation distances of two lethal radii. This dispersion is deceiving, since command and control would be seriously degraded if the communications site alone were destroyed. If the CTOC area alone were destroyed, off-shift CTOC personnel in the life support area could still perform command and control functions, although less efficiently, using only the communications equipment located at the communications site. If the life support service area were destroyed, CTOC and communications site areas could still perform their missions, although somewhat degraded. In order to increase the survivability of the command and control system, the elements of the command post need to be functionally dispersed. This dispersion can be accomplished best by organizing small cells, much like the West German Army corps uses, but at a much greater separation distance. ⁷ A nuclear attack might destroy several cells, but not the entire Main CP. Figure 6-4 provides a display of selected cells illustrating MSD calculated separation distances

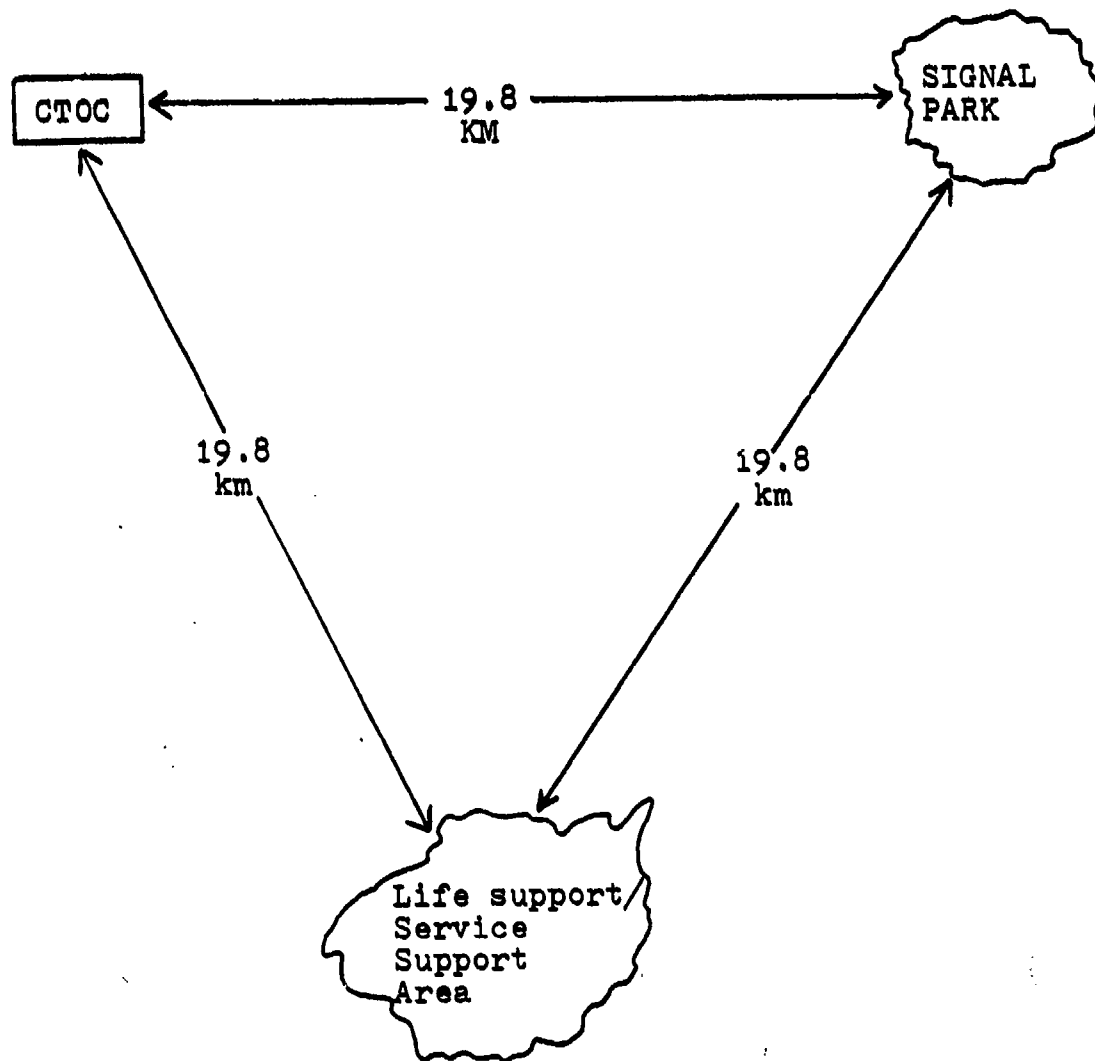
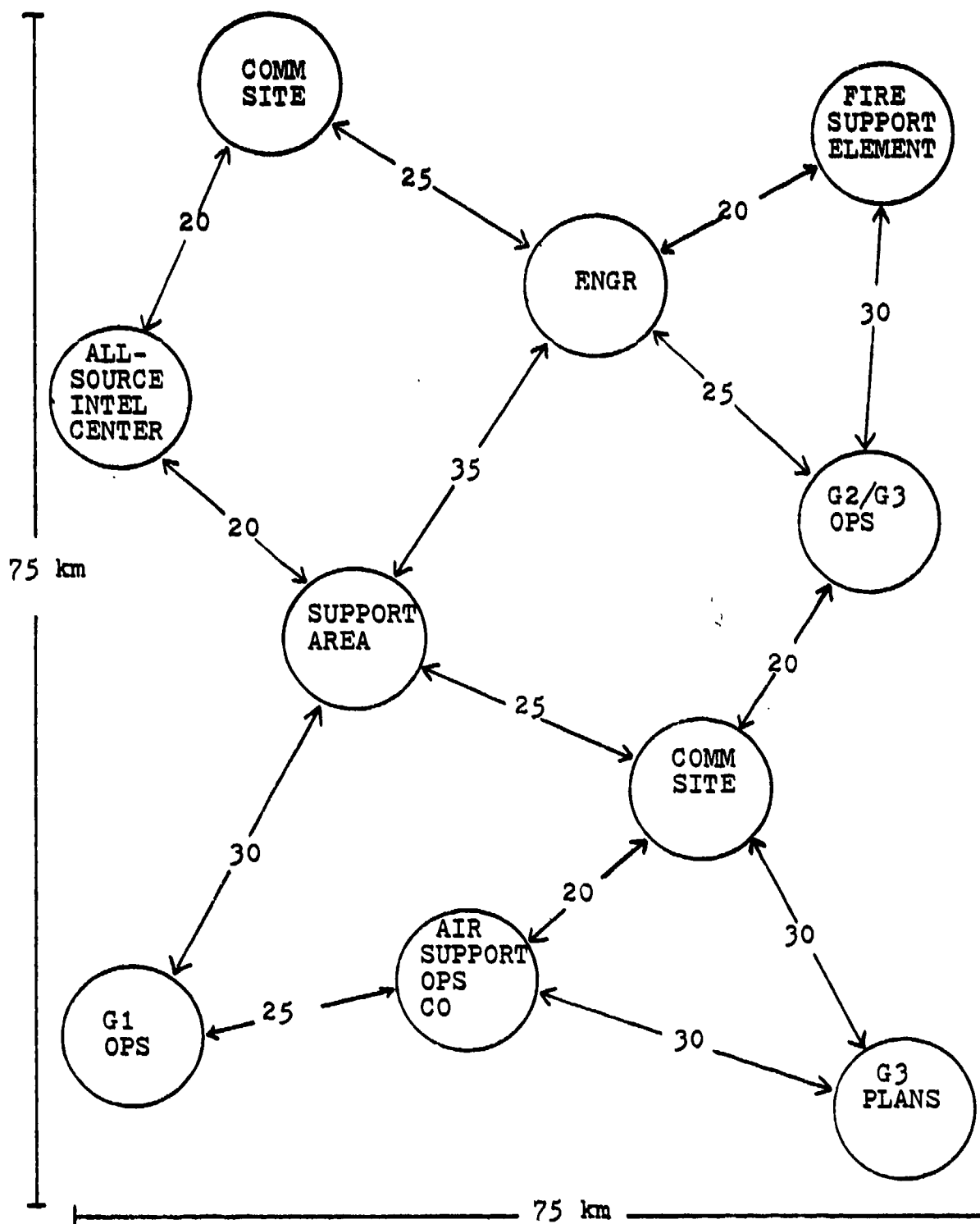


Figure 6-3. Main CP dispersed by two MSD Radii (19.8 km) Separation Distance, based on 100 KT Weapon.



Notes:

1. Support Area is for major maintenance and supply. Life support self-contained in each cell.
2. Numbers in lines represent distance in kilometers.

Figure 6-4. Main CP dispersed in functional cells at a nuclear-safe distance.

of two lethal radii. This configuration provides enhanced survivability of the entire CP-communications, operations, intelligence, and service support.

There is a belief that dispersed command posts may detract from the staff's ability to interact effectively. This belief may be unfounded if the dispersed CP is well-supported. III Corps has developed a dispersed-cell command post concept at Fort Hood, Texas.⁸ Although the amount of separation between cells is usually less than one kilometer, the III Corps staff has accumulated some valuable experience concerning dispersed operations. The staff believes that they are operating in a more coordinated atmosphere than when they were all in the same facility.⁹ The corps uses closed circuit television to present inter-cell briefings to staff elements and to the commander; this system is regarded by staff personnel as reliable in meeting their needs. A significant increase in separation distances could be achieved by using radio-waves rather than cable for television transmission. The current cable system also requires a larger amount of time to emplace/displace than a radio-wave based transmission system.

Section IV. REDUNDANCY

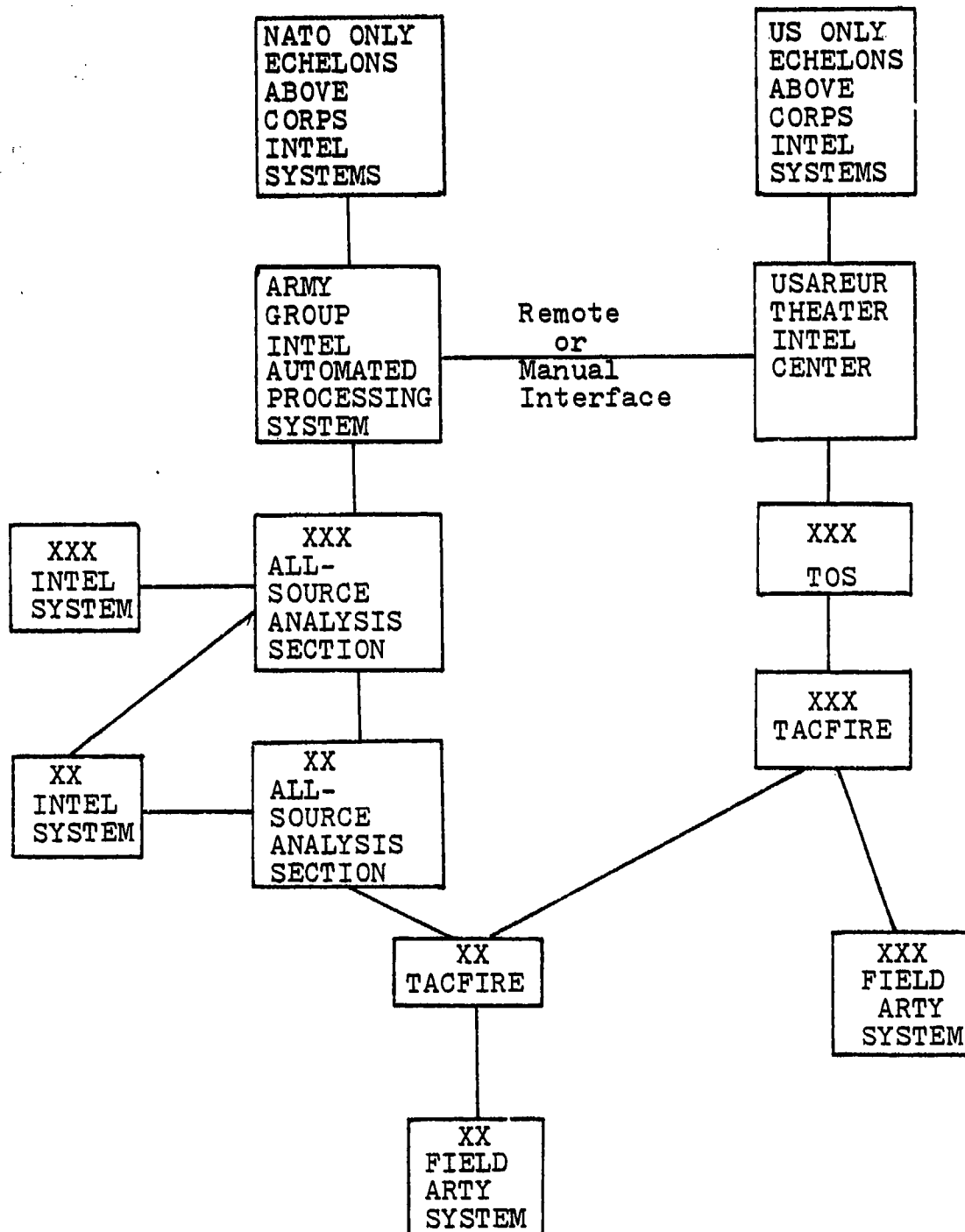
TAC CP vs TRUE ALTERNATE CP. The TAC CP was described in Chapters 4 and 5 as a facility from which the commander might direct the battle in a particular area for a short period of time (less than 36 hours). It does not provide a true alternate to the corps Main CP. The TAC CP, with its

limited communications, is not designed to perform the various missions which the Main CP performs. To increase the survivability of the corps command and control system, a true alternate CP rather than a TAC CP is required. This alternate CP ought to be a mirror image of the Main CP and ought to be dispersed in the same manner as shown in Figure 6-4. This true alternate CP would receive the same information as the Main CP, therefore requiring the same type and quantity of communications as the Main CP. The Alternate CP would thus be able to take control of the battle at any point without complete loss of continuity. This would not only occur in case of nuclear attack on the Main CP, but also if the Main CP cells were to displace more frequently to reduce vulnerability to enemy target acquisition. A TAC CP close to the division battle area in the enemy's main attack zone is not prudent. Such a deployment would expose the commander and staff to unwarranted risk levels of nuclear radiation. The same reasoning is valid for location of the Alternate CP. An Alternate CP, outside the area of intense combat and reconnaissance would be available to marshal forces required to stop a penetration of the division.

Termination of Communications. A true Alternate CP would require more communications than the current TAC CP. This involves a change in equipment quantity authorizations. A different concept to increase redundancy involves a major change in procedures and equipment quantities. This concept is to terminate selected command, control, and intelligence

communications systems at echelons or units in addition to those places where they are currently terminated. This should occur in intelligence targeting and in nuclear release.

1. Intelligence Targeting. Systems which communicate intelligence targeting information should terminate at the corps artillery element and the division artillery elements responsible for nuclear fires against the enemy in a particular sector. Some intelligence collection systems which can provide direct targeting information are automated or semi-automated. Information is sorted by geographic area and passed to the organization responsible for firing missions (air or field artillery) into that area. An argument against such a concept is that the staff is bypassed and a commander loses his prerogative concerning what targets should be fired upon. This argument is not valid since they seldom tell the artillery which particular targets should be fired upon. The field artillery section at the CTOC is given priority areas and type targets as guidance. Artillery is fired based on the quality of intelligence, considering availability of ammunition and artillery pieces. The commander's priority of fires is by area, type of target, and by unit to be supported. Intelligence personnel could be located where intelligence system communications terminate at the artillery organizations. The current system, shown in the Army Battlefield Interface Concept (ABIC), connects two automated systems, such as TACFIRE and selected intelligence systems, by remote and probably manual interface.¹⁰ Figure 6-5 shows intell-



Source: ABIC 79, pp. D-5, D-6.

Figure 6-5. Intelligence Flow Illustrated in ABIC 79.

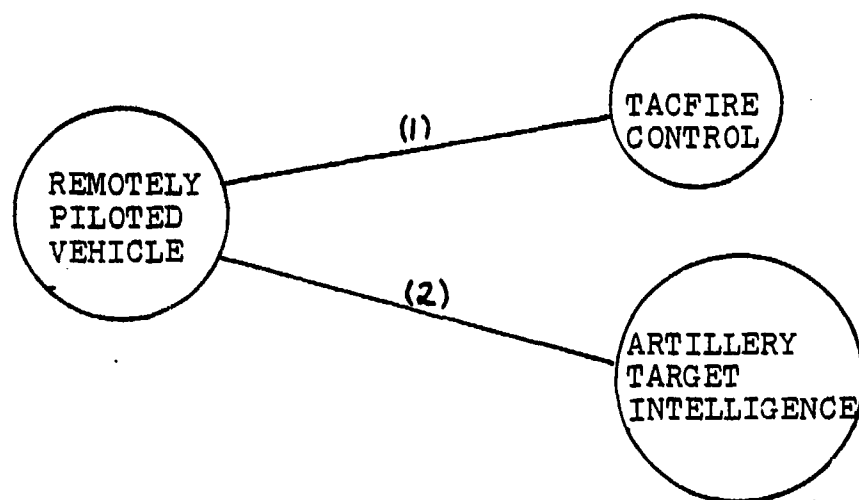
intelligence flowing in one channel from the corps all-source analysis section (ASAS) to division ASAS to division Tactical Operations System (TOS) to division TACFIRE, then to division field artillery systems. Figure 6-5 also shows a second channel of intelligence flowing from the corps ASAS to corps TOS, to corps TACFIRE, to division TACFIRE, and then to division field artillery systems.¹¹ By sending selected intelligence from the collecting system directly to TACFIRE, two things are accomplished:

(1) timeliness of intelligence would be increased;

(2) most importantly, if the Main CP were destroyed in a nuclear attack the artillery would still have timely targets for nuclear fires.

A direct link (Figure 6-6) from remotely piloted vehicles to TACFIRE, such as described above, is illustrated in the ABIC.¹²

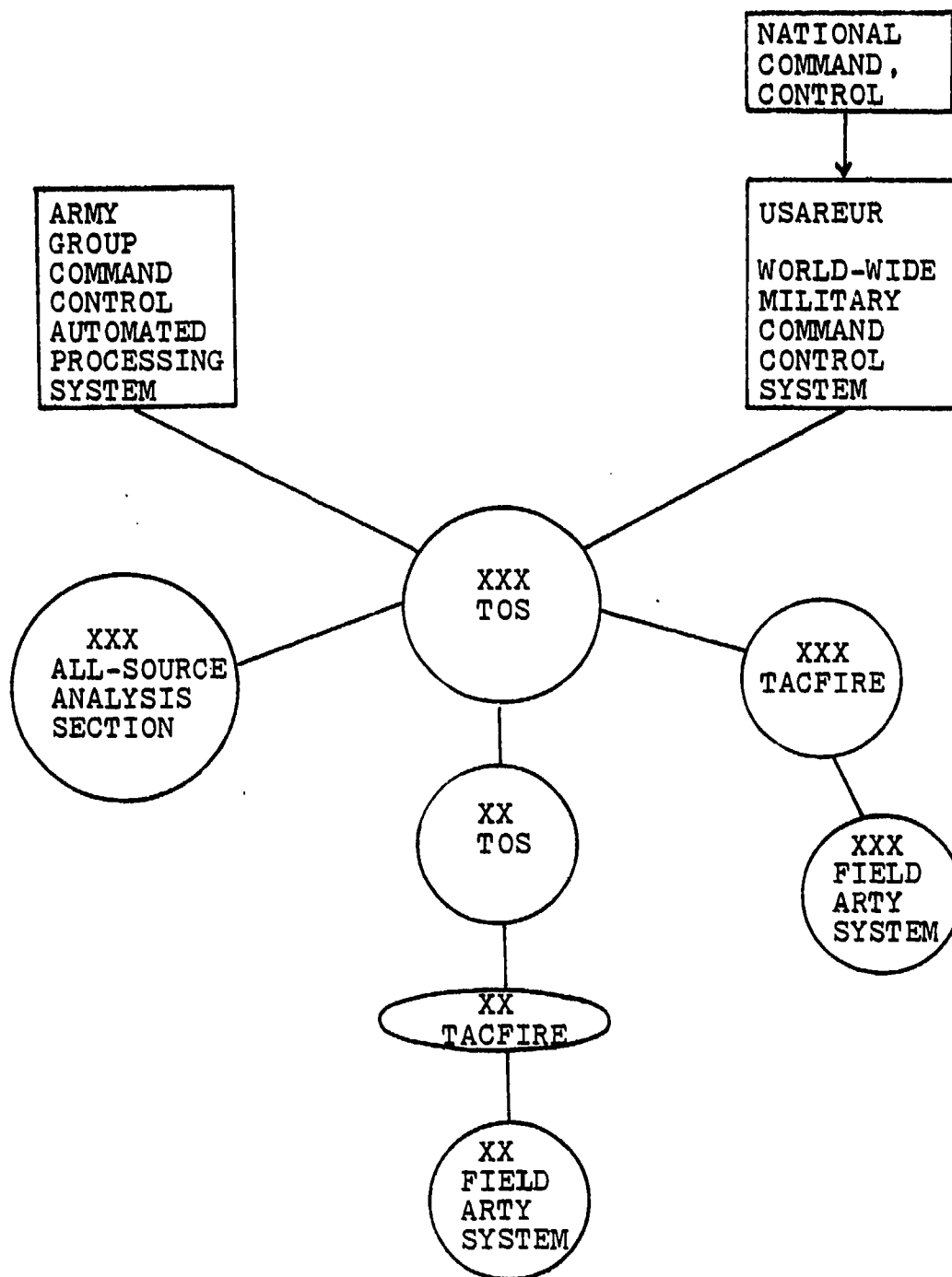
2. Nuclear Release Authority. The same rationale as described above could be applied to the system used for release of nuclear weapons. The ABIC illustrates the flow of command and control information. Figure 6-7 is based on these illustrations. The command and control information from automated systems at USAREUR and CENTAG flows to corps TOS, then to division TOS, to TACFIRE, and then to the field artillery system. One may argue that information from CENTAG or USAREUR can be provided simultaneously to corps and to the divisions through automatic switching in the network



- (1) TACFIRE provides Remotely Piloted Vehicle with mission tasking.
- (2) Remotely Piloted Vehicle provides fire mission data through Quickfire channel

Source: ABIC, p. E-68.

Figure 6-6. Relationships between Remotely Piloted Vehicle and TACFIRE.



Source: ABIC 79, pp. D-5, D-6.

Figure 6-7. Command and Control Flow Illustrated in ABIC.

described above. However, the current communication system from EAC is routed to the division through the corps Main CP signal support facility. If this is destroyed, then the information does not flow to the divisions from higher headquarters unless it is routed through an adjacent corps and then into the corps area signal battalions's multichannel system to the TAC CP and to the divisions. A link such as this would not seem to be very timely or reliable during the enemy nuclear attack or shortly thereafter under conditions of massive disruption and movement of command posts and supporting communications facilities. A more direct and reliable communications system is required between CENTAG/USAREUR, the corps Alternate CP, the divisions, and the field artillery system for transmitting nuclear release messages in a timely manner. This system would insure sufficient redundancy to provide a higher level of confidence that the US corps could employ its nuclear weapons as directed by higher authority at a decisive point in the battle.

Section V.. Communications-Electronics Systems.

General. The preceding descriptions of dispersion and redundancy require a type of communications system not in the current US Army inventory. The current corps TOE does not provide sufficient quantities or types of equipment for redundancy nor for the ability to tie together a number of corps cells scattered over a wide distance. There is some equipment in use by non-US Army organizations and there are several forms of technology being researched which can provide

the type of communications required to support the concept of a command post widely dispersed with sufficient redundancy to greatly improve the survivability of the command and control system. This section describes some of the means which could support the proposed command post architecture.

Systems Used by Other Organizations

1. WAVELL. The British are fielding WAVELL, an automatic data processing system for battlefield command and control. The WAVELL system is similar to the proposed US Army TOS in that it is a mobile computer based system that operates at corps, division, and brigade.¹³ (Note: TOS as a specific hardware system has been dropped from US Army development requirements, but research and development is continuing on a follow-on system with much the same functions). WAVELL is to be deployed throughout the 1st British Corps in Germany in 1982-1983 as a second stage system.¹⁴ The first stage consisted of installing WAVELL assets in 1978 to support operations and intelligence only in HQ, 1st British Corps, the 2d Armored Division, two brigades, and in the "Step-up" CP at corps and division. The corps and division sets consist of processing, storage, and retrieval elements deployed in a 4-ton truck and the brigade sets are in a three-quarter ton Land Rover. Visual display and printing units are remoted to a building, tent, or another vehicle. The British experience during field exercises with WAVELL since 1978 has been favorable. Information arriving at division headquarters through manual input was inaccurate, con-

tradiotory between division and brigade command posts, and was not timely. Information arriving through WAVELL was consistent, timely, accurate, and easy to update. Use of WAVELL has "...led to more flexible operations, better use of total available resources, and better fall-back to alternative headquarters."¹⁵ Such a system deployed in three-quarter ton trucks could support the widely dispersed corps Main and Alternate command posts. The major change to WAVELL desired for a US command post would be the ability to transmit and display graphics. It is currently configured to display only alpha-numeric data.

2. RITA. The French Army will start deploying the RITA system in 1980.¹⁶ RITA is the Automatic Integrated Transmission Network, and will be employed from army through brigade level. It is a meshed-type network consisting of electronic automatic switching units connected by microwave links, cables, and radio-wire integration. It will use both pulse-code modulation and time-division multiplexing for multichannel links between exchanges. RITA has a Network Command Center which provides computer control of communications, displays network status, selects preferred points for new communications sites when displacing, and selects frequencies to be used in its links. This form of automated network control would be most beneficial in achieving the desired redundancy between various dispersed cells of both the Main and Alternate CP, especially if they move frequently. This system is similar in function to the series of tactical

communications equipment being developed by the US TRI-TAC Program, a joint program chartered by the Department of Defense. The French system is currently in production and will be fielded shortly, while the US system is still in the initial operational test stages.

Systems or Technology in Development

1. Military Satellite Communications (MILSATCOM).

The Department of Defense is investigating improvement of the current Defense Satellite Communications System (DSCS-II/III) satellites to communicate with mobile ground and other terminals supporting nuclear-capable organizations.¹⁷ One improvement in near-term systems is the addition of single-channel transponders (SCT) to DSCS-III and other supporting spacecraft. The SCT would be one-way devices used to transmit nuclear release messages. Research is focusing on developing SCT systems which would have improved resistance to jamming and low probability of enemy intercept.¹⁸ Such systems would operate at Extremely High Frequency (EHF), probably around 45 Gigahertz. This system would require a new series of communications equipment to be deployed as mobile ground terminals, since current MILSATCOM terminals are operating in the Ultra High Frequency (UHF) spectrum between 240 and 400 Megahertz.¹⁹

2. Anarchy Band/Spread Spectrum Concepts.

The anarchy band concept focuses on developing a communication regulation system that will allow operation within a specific

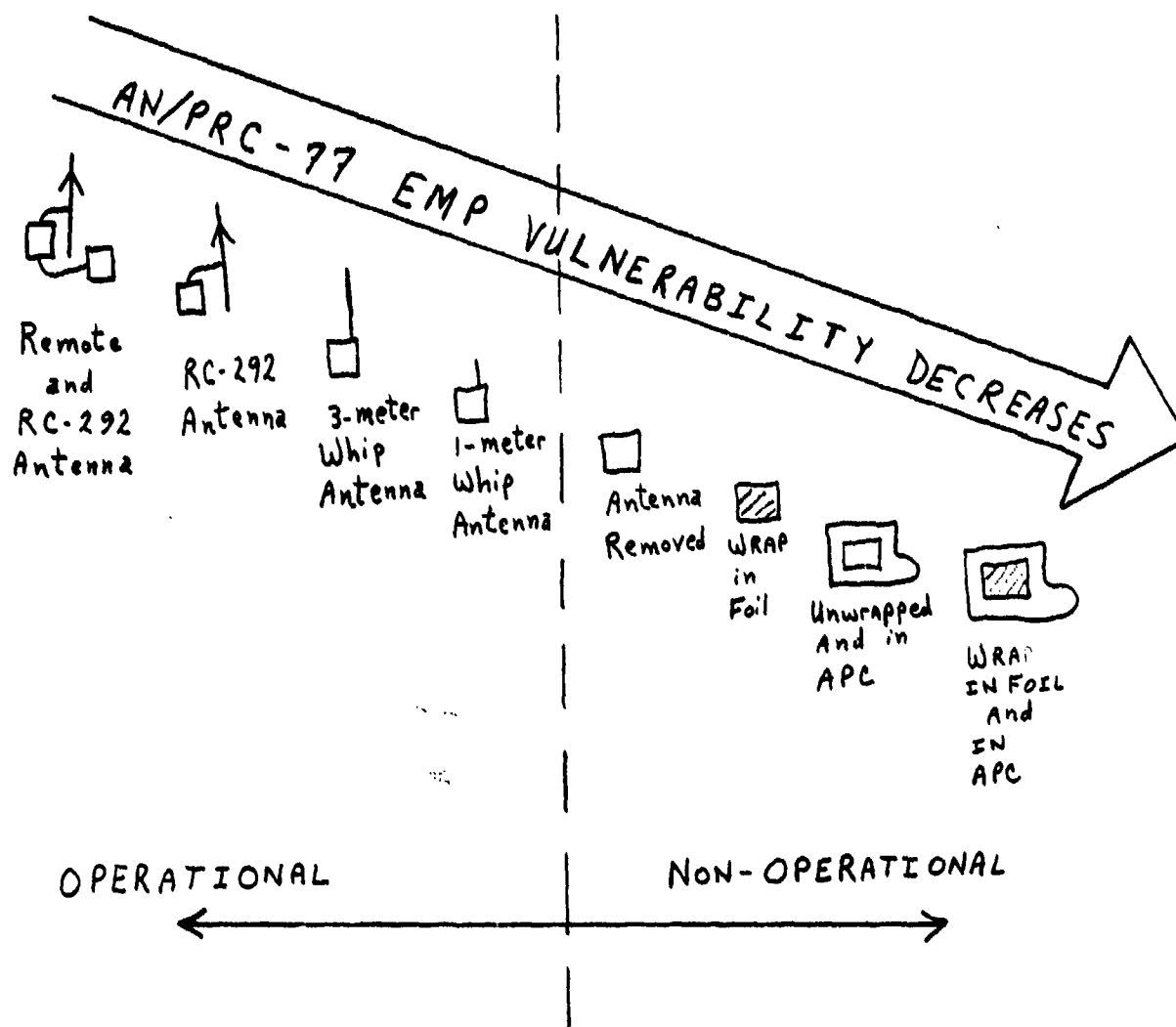
band, but without assigned channels or frequencies. The concept known as spread spectrum communications is one in which a particular communication system would operate over a variety of frequencies as those frequencies are available rather on a predetermined frequency. The DOD Advanced Research Projects Agency (DARPA) has developed a system to operate tactically using the spread spectrum concept; the system is called packet radio.²⁰ Packet radio is a method of automatically transmitting voice and data in a packet of data over any free channel available within a group of pre-designated channels. Through internal query and control systems, any packet not received properly at its intended destination is automatically retransmitted. This concept is based on an existing fixed-station network, called ARPANET, which connects dozens of various computer installations across the US into virtually one network. A packet switching network forwards packets from switch to switch using line circuits or radio or satellite channels.²¹ DARPA is working on a system to integrated the various transmission means and switching centers to service mobile tactical users. Different network types--broadcast (all listeners can hear all transmissions), semi-broadcast (line-of-sight, store and forward), non-broadcast (wire)--are made interoperable since they are each necessary in some way to the tactical user. The packet radio concepts provide efficient methods to support widely dispersed command post cells. They also enhance survivability by providing a great degree of redundancy and high

resistance to jamming. For example, a packet switch keeps trying to send a packet until it has been successfully received. At some point, a switch may determine that an intended receiver is inoperable, either through destruction, jamming, or movement; it will automatically reroute the packet to a designated alternate receiver. The packet radio system does not currently have a graphic transmit and display capability.

The spread spectrum techniques would more than adequately support widely dispersed cells at both Main and Alternate command posts. This function is not efficiently possible using current US Army TOE equipment and procedures. This packet radio system could be available for the 1986-1990 corps command post. As of 1978, at least 28 radios had been built by Rockwell International and delivered to the US government for testing.²²

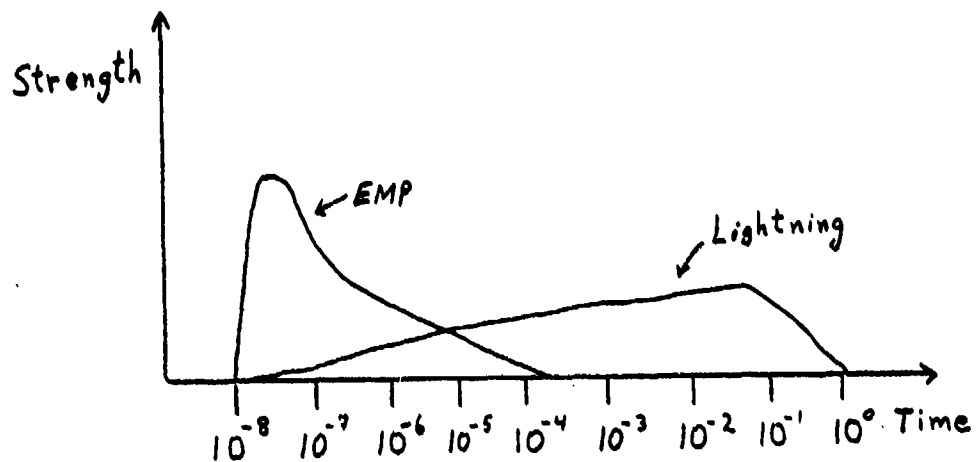
3. Fiber Optics Cable. Use of fiber optic cables in place of metallic cables is being investigated. Communications using current fiber optic cables require repeater stations for ranges in excess of eight kilometers. Advances in fiber optics ancillary devices, such as receivers and amplifiers, are being researched to extend this distance in excess of 50 km.²³ Some advantages of fiber optic cables over metallic cables are: reduced bulk, reduced electronic signature, immunity to EMP, increased reliability, and increased bandwidth.²⁴ Especially important on the integrated battlefield is the ability to operate at long ranges and the immunity to EMP.

4. Microelectronic Switches. Current Army solutions to limiting the damage of EMP to communication-electronics equipment require protective measures to be taken prior to the nuclear detonation in most cases. DA Pam 50-3 lists such measures as: shielding of various types (metal "cages" around equipment; cables buried underground); proper circuit layout; satisfactory grounding; and protective devices (arresters, spark gaps, filters, circuit breakers, and fuses).²⁵ Field Manual 11-50 lists specific methods to implement the foregoing guidance. Such methods include: using highest frequency possible, using horizontal polarized antennas, keeping cable lengths short, using common grounds, disconnecting all equipment not in use, and wrapping disconnected equipment in foil. The methods which are safest are those which usually work only with equipment that is not currently being operated.²⁶ (Fig 6-8). A shortcoming with most current solutions is that they may not prevent the effects of EMP because of the high voltage (20,000 volts per meter) being generated in an extremely short amount of time (10 nanoseconds or ten billionths of a second).²⁷ Most of the grounding methods and protective devices (fuses, filters, circuit breakers, etc) are intended to prevent lightning from affecting communications-electronics equipment. However, lightning has a relatively slow build-up time and less voltage than EMP, as illustrated in Figure 6-9. Thus, these methods and devices, which are designed to operate efficiently against the effects of lightning, do not operate well against the effects of EMP. When



Source: Field Manual 11-50, p. 4-18.

Figure 6-8. Methods to decrease radio vulnerability to EMP.



EMP builds up to approximately 20,000 volts per meter in 10^{-8} seconds (10 nanoseconds or 10 billionths of a second).

Lightning builds up much slower and to a lesser voltage.

Source: Field Manual 11-50, p. 4-15.

Figure 6-9. Comparison of EMP with Lightning.

they are used, they must be used in connection with other preventive measures.

Current switches, filters, fuzes, circuit breakers, and spark gaps are not able to operate faster than the EMP buildup. However, the new microelectronic technology being developed has the potential for providing the required high speed switches. The state-of-the-art semiconductor switch technology used in computers has been able to achieve a cycle time (one switching) of 12 nanoseconds (12 billionths of a second).²⁹ This is almost fast enough to switch the EMP voltage at 10 nanoseconds build-up time. The new microelectronic technology is based on the "Josephson junction," a device which can change state (switch) in as little as 6 picoseconds (six trillionths of a second). This junction is based on the superconductivity of the materials from which it is made and on the "tunneling" of electronic charges across an insulating barrier.³⁰ (The tunneling phenomenon is based on research conducted by Brian D. Josephson at Cambridge University in 1962). The Josephson junction requires temperatures close to absolute zero in order to achieve the 6 picoseconds switching speeds.³¹ Such switches would enable communications-electronics equipment to be operational and still be protected from the effects of EMP. The switches could be built into power connections, antenna connections, and in lead-ins to circuits. Equipment would be operated normally and if EMP effects were transmitted to the equipment, the Josephson junction switches would automatically route the voltage to a specific grounding

circuit. Such switches also may be helpful in designing radiological monitoring instruments that would be EMP hardened.

Employment of Josephson junctions would require cryogenic equipment for supercooling switches to the near-absolute zero temperatures required for proper superconductivity condition and heat dissipation caused by high wattage from voltage currents concentrated in such small areas. Such cryogenic equipment has been developed already to support the operation of thermal imaging devices.

Section VI. PHYSICAL FACILITIES AND MOBILITY CONSIDERATIONS

General

The corps Main and Alternate command posts need to be highly mobile but also structured to take advantage of hardened or semi-hardened facilities whenever possible. The current TOE for corps HHC provides transportation assets for a maximum of 18% organic mobility to move personnel and 30% organic mobility to move supplies and equipment; of transportation assets must be requested from the corps support command.

Mobility

1. The service support of a widely dispersed headquarters requires mobile teams to provide vehicular and communications-electronics maintenance to the various cells. This requires additional transportation assets devoted to or

organic to corps HHC.

2. The cellular elements of the CTOC should have organic transportation. Currently, the G2 and the G4 staff sections have over 30 personnel each, and yet each of these staff sections is authorized one $\frac{1}{4}$ -ton vehicle. These cells, when dispersed, should be compact and operate from a small number of organic vehicles designed for operational, communications, and life support functions. Microprocessors for operations support and for communications systems would assist in obtaining the desired compactness of each functional cell. Each cell could operate from vehicles the size of the current $\frac{5}{4}$ -ton truck with a modular shelter system (ie. different shelters for communications, work area, sleep, and mess area, and personnel and equipment transport, all mounted on the same type chasis). The British Army has modified a $\frac{3}{4}$ -ton Land Rover into a "Carawagon tactical command post vehicle" for use by commanders of general officer rank.³¹ They have also mounted a WAVELL set into a modified Land Rover. A similar vehicle could be used to support the dispersed corps command post cells.

Transportability

Each cell should be small in size and have vehicles which are small enough and sturdy enough to be sling-loaded and transported by helicopters organic to the corps (BLACK-HAWK or CH-47), using as few sorties as possible. This displacement by air would help in bypassing contaminated areas

and also minimize the time it takes a CP to displace. It would not move by air all the time, nor would all cells move by air simultaneously. In the case of nuclear attack, this would be a good method to move selected cells rapidly, avoiding contaminated areas and areas of massive destruction and obstacles.

Life Support Services

Small vehicles, such as those discussed above, could be modified for sleeping and eating, much like many of the recreational vans so popular in the US civilian community today. Food service could be simplified, using a combination of freeze-dried foods, microwave cooking technology, and portion-controlled, pre-packaged dinners like commercial airlines provide.

Use of Existing Structures

1. Use of existing hardened or semi-hardened structures could be used to enhance protection from weapons effects and to reduce target acquisition vulnerability. If mostly 5/4-ton type vehicles were used rather than current 5-ton expansible vans, the cells of the CP could fit into a variety of buildings, not just large barns, factories, and warehouses. Equipment would not have to be unloaded into a structure and loaded back into vans every time the cell moved, thus increasing the timeliness in which these elements could emplace/displace. The various cells would not occupy the same fixed facilities for great lengths of time, since this might increase their vulnerability to enemy targetting.

2. Use of defilade positions or earth shelters could enhance protection from blast and thermal effects. Small, high-speed trenching machines, such as those used in civilian construction firms, could be used to create such defilade positions or earth shelters. This construction could be done at a variety of preplanned locations, and CP cells could emplace into them as required.

3. The construction of permanent, hardened facilities specifically for a corps is not tactically desirable, since the areas of deployment should be in reaction to an enemy threat. The corps must be flexible enough to fight a war with little warning on terrain or along avenues other than those contained in the corps general defense plan. Friendly intelligence estimates, derived during peacetime, might reflect high confidence that "the enemy most likely conduct his main attack along avenue A with three divisions, supported by a division each along avenues B and C." The enemy may have a different view of the battlefield, ignoring avenues A and B and conducting a main attack on avenue D, with two divisions in first echelon and one in second echelon. Supporting attacks may be on avenues C and E, with each having one division in first echelon and one division in second echelon.

Such a situation occurred in France in 1940, where the Allied armies were deployed along the Dunkirk-Sedan-Magnot Line. There was a prearranged plan to move the Allied forces from the French-Belgian border north-northeast to the

Dyle Line if the Germans attacked in the north through Belgium instead of along the Maginot Line. The Germans did attack Holland and Belgium in the north and the Allies executed the plan to swing north toward the Dyle Line. However, the Germans did not see the situation in terms of "either-or," i.e., either attack along the Maginot Line or attack in the North. Rather, they made a major effort going through the Ardennes toward Sedan, the hinge of the Allied turning movement. A formal model of this situation was formulated and analyzed by two professors from Sussex University. Their analysis used a hypergame approach which does not assume that all "players" see the same "game."³²

Permanent fixed facilities constructed specifically for corps command posts, if constructed much before the war began, would be more susceptible to identification and location by enemy intelligence reconnaissance or agents. Having identified and located the facilities as command posts, the enemy would plan to destroy them through acts of sabotage by partisans or guerilla forces.

A permanent fixed facility constructed specifically as a corps command post would reflect an inflexibility of thinking as would an unchanging belief that the enemy most likely will follow the scenarios described in our general defense plans. If it were desirable to deploy the corps headquarters in a permanent, hardened command post facility, then at least there should be a series of these facilities established laterally and in depth to provide some flexibility in

wartime deployment in response to enemy maneuvers. We must not fall into the trap of our own minds by deploying against a threat as we estimate it during peacetime, but rather we should be prepared and capable to deploy rapidly in reaction to where the enemy actually is maneuvering. Small, widely dispersed, and highly redundant command post cells would provide a better degree of flexibility than permanent fixed facilities.

Section VII. SUMMARY OF ANALYSIS

Design Against the Threat

The corps command posts for operations on the 1986-1990 integrated battlefield should be structured to provide enhanced survivability against 100 KT or larger nuclear weapons. Such weapons would be delivered by the SCUD missile or its replacement.

Command posts remain vulnerable to direct ground action by long-range reconnaissance patrols, sabotage by partisans or guerillas, and attack by forward detachments of the combined arms/tank army. There are a large number of people in the current command post who can help defend against this type of threat and the area of the command post is quite large for an attack by a small team to be completely successful. With widely dispersed command post cells, it may be more difficult for these threat teams to locate each cell. However, once a small cell is found, it might be more easily

destroyed by one of these teams because of fewer personnel available to protect it and because the cell occupies a relatively small area.

Dispersion

A corps command post designed against a 100 KT or larger nuclear weapon should have its major functional elements dispersed (Figure 6-4). Upper and lower bounds for this dispersion provide guidance for designing associated support systems.

1. The lower bound should be a separation distance not less than two lethal radii of the 100 KT weapon measured in terms of nuclear radiation's latent lethality (500-650 rad initial exposure) or in terms of nuclear blast maximum overpressure (7 psi for a CP in concrete structures, 5 psi for a CP in tents and vehicles), whichever of the two effects occurs at the greater range.

2. The upper bound should be a separation distance not less than two radii of the 100 KT weapon measured in terms of Minimum Safety Distance for negligible risk-level exposure (less than 70 rad) to warned, protected personnel.

Redundancy

1. A true alternate CP is required to perform the function of the Main CP if the Main CP is destroyed. The current TAC CP cannot immediately take control of all the functions of the Main CP due primarily to lack of communi-

cations assets at the TAC CP and the lack of duplicate functional cells.

2. Communications systems from intelligence collectors at corps and echelons above corps and from command and control organizations in the nuclear release chain of command ought to terminate at the Alternate CP, corps artillery, and division artillery individually and should not be an extension through the communications facility supporting the corps Main CP. This would provide more timely targeting information for friendly nuclear weapon fire planning and would provide more assurance that nuclear weapon release authority would be transmitted to appropriate nuclear capable organizations.

Communication-Electronics Systems

Automated systems for reporting, processing and displaying information should be used to facilitate command and control. Such systems are already in production or fielded in the French and British Armies at the corps level. Military satellite communications and spread spectrum concepts and technology, such as packet radio, are capable of supporting a widely dispersed and highly redundant structure of command post cells. Current system prototypes, such as packet radio and WAVELL, have not incorporated graphic display capabilities, but do have alpha-numeric displays. Technology is being developed in the computer industry which could reduce the vulnerability to EMP, such as the Josephson junction switch. Required Operational Capability (ROC) documents

for development and procurement of such systems ought to be formulated by the Training and Doctrine Command and approved by Department of the Army in the implementation of the proposed command post cellular concept.

Physical Facilities and Mobility Considerations

1. Mobility. A large quantity of dispersed command post cells requires an increased quantity of vehicles for service support as well as for rapid emplacement/displacement. The types of vehicles would be somewhat different than those in the current TOE, but not much different than vehicles currently in service with the British Army or those widely used for recreation by civilians in the US. Such vehicles ought to be developed for military use and procured.

2. Physical Facilities. Hardened or semi-hardened structures in towns/villages should be used where available in consonance with the tactical deployment of forces to meet an enemy threat. Construction of a permanent hardened facility specifically for a corps headquarters lacks flexibility to deploy in rapid reaction to threat force maneuvers. Use of defilade positions or earth shelters could be made more feasible by acquiring small, high speed trenching equipment.

Section VIII. CONCLUSIONS

There are current systems already fielded and systems in research and development which can be fielded in 1986-1990 to support widely dispersed and redundant corps command post

cells. The wide dispersion (at least 20 km) of command post cells improves survivability. Survivability and redundancy can be achieved by--

1. Deploying a true Alternate Command Post.
2. Terminating intelligence and nuclear release communications at the TAC CP, corps and division artillery command posts independent of the Main CP signal site.
3. Fielding a large, interconnected communications system made survivable and effective by using spread spectrum techniques, military satellite communications, and built-in EMP protection to allow continuous communications.

Therefore, the hypothesis is supported in that there are solutions which reduce vulnerabilities and enhance the effectiveness of corps command posts on the 1986-1990 integrated European battlefield.

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CHAPTER 7

EVALUATION

Section I. SUMMARY

General

The focus of this research has been on three major areas--the nature of the 1986-1990 European battlefield, the vulnerabilities of corps command post architecture on that battlefield, and the identification of proposed solutions to reduce those vulnerabilities. After estimating that the battlefield would most likely be integrated, current US Army concepts were examined to determine how vulnerable command posts were and what solutions might be available to reduce those vulnerabilities and still enable corps command posts to operate in an effective manner.

Nature of the 1986-1990 European Battlefield

Major US Army doctrinal publications concerning military operations contain very little information about nuclear operations, but they do stress chemical and conventional operations. Soviet military authors and non-Soviet authors who have studied the Soviet Union's military capabilities portray the Soviet Union as willing to use nuclear weapons on the European battlefield. There is no consensus among those authors concerning the phase of the battle

in which the Soviet Union would use nuclear weapons. Almost all authors agree that the Soviet Union definitely would use such weapons at some point on the European battlefield in the event of war with NATO.

Current Command Post Concepts

The US Army corps uses three command posts routinely-- Main, TAC and Rear. The British and French use a Main and a Rear CP routinely, and deploy a TAC CP only at selected times. The Soviets use a Main, an Alternate, and a Rear CP, and deploy a TAC CP only at selected times. The West Germans use a Main and a Rear CP, designate a subordinate headquarters as the site of an Alternate CP if one is required, and do not use a TAC CP.

Inadequacies of Current Corps Command Post Architecture

A review of US doctrinal literature and current practices revealed several inadequacies concerning the effectiveness and survivability of current corps command posts operating on the integrated battlefield. These inadequacies were used to develop criteria for a different architecture.

1. Main CP. If the Main CP were attacked with nuclear weapons of yields 100 KT and larger, it would be totally destroyed (i.e., unable to perform its mission). Its vulnerability is primarily based on lack of dispersion and of redundancy.

2. TAC CP. The TAC CP is designed to function

for short periods (about 36-48 hours). It does not have the capability to assume the functions of the Main CP, primarily due to lack of independent communications systems and of personnel from various staff sections other than G2, G3, and Fire Support Element.

3. TAC CP Deployment. A TAC CP deployed in the division area on the enemy main avenue of attack is extremely susceptible to enemy target acquisition, nuclear attack, and destruction on the integrated battlefield.

Proposed Solutions

1. The SCUD missile or its replacement is the most likely system with which to conduct a nuclear attack on the corps Main CP. The SCUD missile can deliver a nuclear war-head 100 KT or larger. Corps command posts should be designed to enhance survivability against this weapon system or its replacement.

2. Since the Main CP's lack of dispersion makes it more vulnerable to effects of nuclear weapons, the Main CP should be dispersed into functional cells. Upper and lower bounds for the degree of actual dispersion were determined by analyzing nuclear radiation, air blast, and EMP effects of 100 KT weapons.

3. Use of calculations based on cumulative dose radiation exposure rather than on single dose rate exposure provides a more realistic approach to determining separation distances for CP elements. These calculations take into account previous exposure of units or personnel.

4. Redundancy of command and control systems can be enhanced by using a true Alternate CP, by terminating communications from selected intelligence collectors and command and control systems independently at corps Alternate CP and at field and missile artillery headquarters at corps and division level.

5. Communications-Electronics Systems and technology to facilitate command and control are available Within the US and in other countries. Such systems as the British WAVELL, French RITA, and the US DARPA packet radio would be required to effectively support widely dispersed, redundant command post cells. Variations of Josephson junction switches may help reduce the effects of EMP. These systems increase the assurance that the US would have a survivable method to direct and implement nuclear weapons attacks at corps and below.

Section II. EVALUATION OF RESEARCH

Issues Which Were Identified But Not Resolved

There are some issues which are either explicitly or implicitly identified in this research but were not subjected to research. These issues were not resolved, but are listed as a basis for further research.

1. Actual methods of enemy nuclear attack must be ascertained to get a more accurate estimate of vulnerabilities. An all-source intelligence study might reveal how the Soviets actually perform target analysis and decide on

which is the most effective means of attack on a particular type of target. The further research might determine if Soviet nuclear targeting is based on--

- a. Single target/Single weapon/Single aimpoint.
- b. Single target/Multiple weapons/ Multiple aimpoints.
- c. Single target/Multiple weapons/Single aimpoint.
- d. Area saturation versus defined target.
- e. Preferences for use of air delivery versus missile delivery.

If such information is not available, then a parametric analysis should be done to determine a range of vulnerabilities based on the various targeting methods. This research primarily examined "area saturation" (Figures 5-3 and 5-4) and "single target, multiple weapons, multiple aimpoints" (Figures 6-1 and 6-2).

2. Rigid quantitative analysis was not used to measure the reduction in vulnerability achieved by proposed solutions. For example, one cannot conclude as a result of this study that the proposed command posts will most likely survive ten days more on an integrated battlefield than the current command posts. One can make qualitative statements such as--

If the Main CP, as currently configured were attacked with 10-16 nuclear SCUD missiles, it most likely would be totally destroyed, i.e., permanently unable to

perform its mission. If the Main CP, widely dispersed in cells as proposed in this research, were to be attacked with the same quantity of nuclear SCUD missiles (10-16), it would be more survivable and continue to be effective. The current command post could be destroyed by area saturation with 10-16 weapons, whereas it would require 490 nuclear SCUD weapons to achieve the destruction by area saturation of the command post dispersed as proposed. Enemy intelligence and reconnaissance would have to be greatly enhanced in order to achieve destruction of a dispersed Main CP using "multiple targets/multiple weapons/multiple aimpoints" as the criteria for nuclear targeting.

3. This research focused on reducing vulnerabilities to the effects of nuclear weapons. It did not address the effects of conventional operations. Since the corps Main CP is so far behind the FEBA, the most threatening non-nuclear operations are aircraft attack and direct attack by long-range reconnaissance patrols, sabotage by partisans or guerillas, and attack by forward detachments of the combined arms/tank army. Current studies are focused on solutions to protection from such attacks.

4. Solving the communications problems at the corps command post requires that the communication problems be solved at higher and subordinate headquarters. Command and control would not be effective if the EMP vulnerability were reduced at the corps command post, but the corps was not able for other reasons to communicate with other units.

5. Solutions which require support of developing technology require that each of the technological systems be fielded concurrently. For example, the use of Josephson junction switches requires that a super-cooling device be fielded in tactically useable packages.

6. Closed circuit television systems for inter-cell communications need to have a communications system which enables broadcast by radio-wave to distances greater than 20 kilometers. Such technology was not investigated.

Issues Which Were Not Addressed

This research did not attempt to address certain issues which are germane to implementing any recommended architecture. Such issues are beyond the limited scope of this research, but should be considered in a more detailed study. A brief listing of these issues follows:

1. Detailed personnel requirements.
2. Detailed composition of functional cells.
3. Replacement missile for SCUD with different nuclear warhead, such as enhanced radiation ("neutron bomb" technology).
4. Cost of proposed architecture.
5. Schedule for completion of systems in development.
6. Concurrence of NATO military headquarters with new or additional communications-electronics interfaces.

Section III. CONCLUSIONS

The Integrated Battlefield

A review of literature written by US, Soviet, and NATO professional military and political authors was made to

determine the most likely nature of the 1986-1990 European battlefield. The results of this review support the hypothesis that the 1986-1990 European battlefield most likely will be integrated, i.e., characterized by the use of nuclear and conventional weapons.

Tactical Doctrine

A review of US Army doctrinal literature and selected procedures concerning division and corps command post operations was made to determine the degree to which they are based on criteria for survival on the integrated battlefield. This review revealed that the US Army's tactical doctrine for corps command post operations on the integrated battlefield is not adequately defined. In view of these findings, it appears that one can partially accept the hypothesis that current corps command posts are not designed to be survivable on the integrated battlefield. When considering nuclear weapons effects only, they are not designed to be survivable. When considering conventional effects only, they are designed to be survivable.

Nuclear Weapons Effects

Charts, tables, and analytic equations were used to calculate the effects of nuclear radiation, overpressure from blast, thermal radiation, and electromagnetic pulse on hypothetical command post deployment based on current US Army concepts. Selection of nuclear effects data was based on the estimate that the most likely nuclear weapons to be used by

threat forces are the FROG rocket or the SCUD missile against the TAC CP, and the SCUD missile against the Main CP. If these command posts were attacked with such weapons, this analysis concluded that these command posts would be totally destroyed, i.e., permanently unable to perform their mission. This analysis supports the hypothesis that current command posts would not be survivable and effective on the integrated battlefield based on vulnerabilities to the effects of nuclear weapons.

Criteria for Command Post Architecture

This research has identified concepts, procedures, technology, and systems which can be used to design future command posts that are survivable on the integrated battlefield. Thus, this research provides sufficient evidence to accept the hypothesis that there are solutions which can be used in reducing the vulnerabilities and enhancing the effectiveness of corps command posts on the 1986-1990 integrated European battlefield.

Section IV. RECOMMENDATIONS

Tactical Doctrine

The US Army should include more extensive discussion and more practical guidelines concerning operations on the integrated battlefield in its doctrinal manuals.

Command Post Architecture

The US Army should develop corps command posts for the 1986-1990 integrated battlefield in Europe based on the following criteria.

1. Design against the threat of a 100 KT or larger nuclear weapon delivered by the Soviet SCUD missile or its replacement.
2. Disperse the Main CP by functional cells at separation distances that consider cumulative rather than single dose exposure to nuclear radiation. An upper bound on separation distance can be obtained by doubling the "Minimum Safety Distance" from intended point of nuclear weapon detonation calculated for warned, protected personnel. This distance is at least 20 kilometers when designing against the SCUD missile with a 100 kiloton warhead.
3. Deploy a true Alternate Command Post, dispersed in functional cells like the Main CP, with a communications system that does not depend primarily on the communications site supporting the Main CP.
4. Terminate communications for selected intelligence systems and for nuclear release systems at the Alternate CP and at division and corps artillery cells independent of the communications site supporting the Main CP.
5. Support the proposed command post by using already-fielded equipment and by systems in near-term development. Electronic microprocessing, such as Josephson junction switches, will help reduce the effects of EMP and also

help to keep the functional cells compact. Such switches might be used to develop EMP-hardened radiological survey instruments. Spread spectrum technology, such as packet radios and switching, will help dispersed and redundant cells operate effectively. Vehicles such as the 5/4-ton truck can be modified for a variety of roles, such as operational workspace, communications shelters, and life support centers, to enhance the mobility of these compact cells.

Programming and Budgeting

The US Army should develop doctrine and formalize requirements for improved corps command post systems to be operational on the 1986-1990 integrated battlefield in Europe. These requirements should be included now in programming documents (POM; FYDP Procurement Annex) to compete for funds necessary to implement the new command posts.

The Army must state formal requirements for the capability available through spread spectrum technology to support widely dispersed and redundant cells and through microelectronic switches to reduce the effects of EMP.

In order to accomplish these actions, the necessary Required Operational Capability (ROC) documents must be formulated by the Training and Doctrine Command, coordinated with the Development, Acquisition, and Readiness Command, and validated by Headquarters, Department of the Army.

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